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FEB 22 1916

FEB 22 1916

VOL. XLI.

NO. 1.

AUTOMOBILE JOURNAL

\$1.50 the year
10 cents the copy

PAWTUCKET R.I.

Feb. 10, 1916

1916 Automobile Advertising Record

Every make of pleasure car built in one of the largest cities of America, noted for its automobile industries, will be advertised in the

Great Boston Show Issue Automobile Journal

ADVANCE NUMBER, February 28. REVIEW NUMBER, March 10.

Display Held March 4 to March 11.

BOTH PLEASURE AND COMMERCIAL CARS.

The Boston show is the business show of the year, and the Journal covers the entire field from which it will draw.

Every trade interest and more than 20,000 owners of cars can be reached for one expenditure. *No duplication of circulation.*

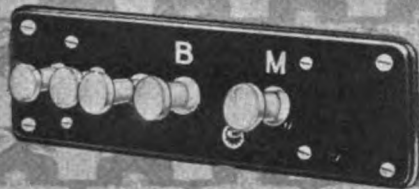
SPECIAL NOTICE: Starting with the February 28 Advance Show Number of the Automobile Journal, the size of page of this magazine will become standard. The type page 7 $\frac{1}{4}$ by 10 inches; The full page 9 by 12 inches.

Make your space reservation today. Last form closes February 20.

AUTOMOBILE JOURNAL
TIMES BUILDING PAWTUCKET, R. I.

Published by the Automobile Journal Publishing Company

HAVE YOU EVER NOTICED YOUR IGNITION SWITCH ? IS IT LIKE EITHER OF THESE ?



Have you ever gone into the real meaning of the letters "M" and "B" or "Mag" and "Bat" on the switch?

Do you know that when magneto ignition for internal combustion motors received the world's seal of approval the magneto switch came into being?

Magnetos of the low tension type superseded the earlier coil ignition, but, as batteries were retained for starting purposes, the ignition switch contained the letter "M" or the abbreviated "Mag" for **Magneto** and "B" or "Bat" for **Battery**.

The growing popularity of the high tension magneto gradually eliminated batteries, and the simpler form of cut-out switch came into being.

But the "M" for "Magneto" and "B" for "Battery" or the shortened "Mag" and "Bat" switch was retained by the older dual system magneto ignition, and throughout automobiledom the world over it was recognized that "M" or "Mag" stood for **Magneto** and "B" or "Bat" for **Battery** on such switches.

Have you ever stopped to think what the letter "M" or term "Mag" designates on your ignition switch or whether it designates anything?

CAN YOU ACCOUNT FOR THE LETTER "M" OR THE TERM "MAG" ON YOUR IGNITION SWITCH IF YOUR CAR HAS NO MAGNETO ?

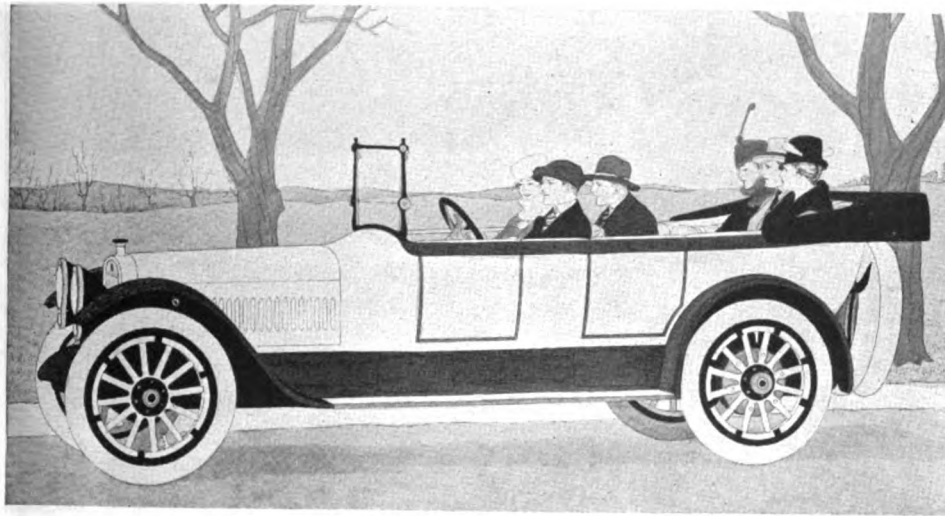
If you cannot, see what explanation you can get from the agent who sold you the car.

SPLITDORF ELECTRICAL COMPANY
NEWARK, NEW JERSEY



THE AUTOMOBILE JOURNAL. 1

WINTON SIX



The Second Longing Look

STREETS are filled with cars of monotonous similarity. Many an owner identifies his own car by checking up the license number. 🐾 Traffic is a double stream of ordinary blacks and greens. 🐾 At rare intervals, in cheerful contrast, the dull monotony is relieved by a distinctly individual car. 🐾 Its owner has chosen a "different" design: its harmonious colors reflect excellent personal taste. Passersby take note. 🐾 They turn for a second longing look. 🐾 For they are human beings and they love the beautiful. 🐾 They recognize at sight that this is not merely anybody's car; it is personal property; it belongs to a real person.

TWO SIZES

33 - - \$2285

48 - - \$3500

Complete information
on request.

We submit individual
designs on approval.

Winton Six cars are built for men and women whose taste demands the genuinely good things of life. 🐾 We take the keenest interest in making your private car exactly as you want it. 🐾 Let us talk it over with you.

The Winton Company

131 Berea Road, Cleveland

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EAGLEINE OILS
are unequalled for motor lubrication, freer from carbon, economical because they protect the motor against mechanical wear, and the quantity required is comparatively small.

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AND SUPPLY CO.
104 BROAD ST. BOSTON.

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Vanderpool, Springfield, O.

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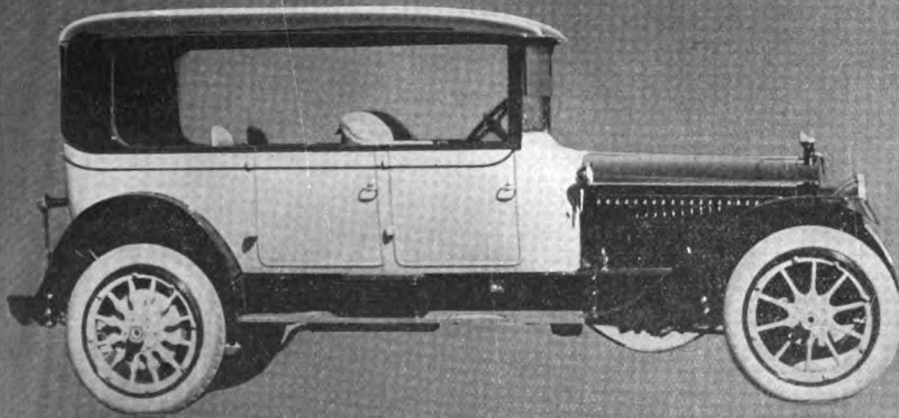
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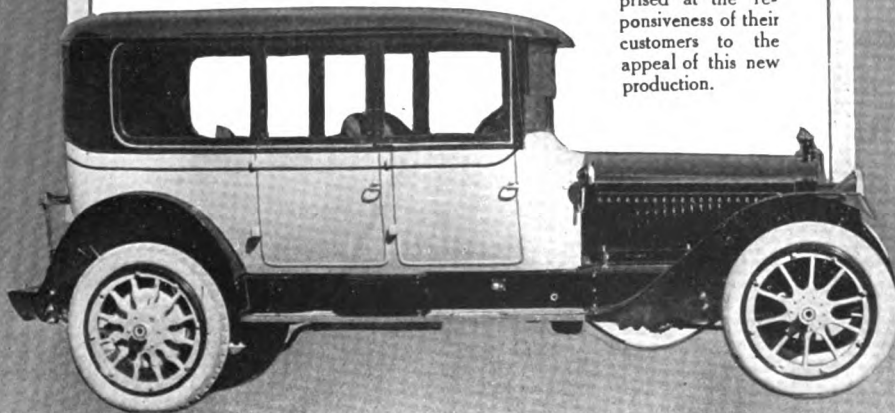
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THE limousine and the touring car are completely satisfactory only in certain seasons. The new Springfield Demi-Convertible body has no such limitations; it is the all-year, all purpose body.

More and more in America, as in Europe, the tendency is to demand protection from the sun, the dust and sudden showers even in touring. This body with its permanent top provides such protection, while it gives plenty of air and an unobstructed view. It may be converted into a limousine.

Dealers will be surprised at the responsiveness of their customers to the appeal of this new production.



SPRINGFIELD METAL BODY Co.
SPRINGFIELD, MASS.

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Buyers' Reference and Guide.

(Yearly Advertisers Only Are Listed in This Guide.)

ACCESSORY MANUFACTURERS AND JOBBERS.

Auto Parts Co., Providence, R. I.
Faw, J. H., Inc., 41 Warren St., New York City.

Times Square Auto Co., 56th St., at Broadway, New York City.

AIR COMPRESSORS AND TANKS.

Brunner Mfg. Co., Main Office and Factory, Utica, N. Y.; New York Office, Hudson Terminal Bldg., 30 Church St. (Brunner.)

Williams Foundry & Machine Co., Akron, O.

AIR PUMPS.

Gardiner Governor Co., 126 Williamson St., Quincy, Ill.

Lipman Air Appliance Co., 199 Pleasant St., Beloit, Wis. (Portable, Stationary.)

ANTI-RATTLERS.

King Specialty Mfg. Co., Brookline, Mass.

AUTOMOBILE ACCESSORIES.

Motorcycle Accessories Co., St. Paul, Minn.

AUTOMOBILES. (See Cars.)

AUTO PRESS.

United Eng. & Mfg. Co., 180 Pearl St., Hanover, Penn. (Manley Universal Auto Press.)

AUTOMOBILE SPECIALTIES.

Motor Specialties Co., Waltham, Mass.

AUTO SPRINGS. (Boltless.)

Harvey Spring Co., 851 17th St., Racine, Wis.

AUTO STORAGE COVER.

Kennedy Car Liner and Bag Co., Shelbyville, Ind.

AXLES.

Russel Motor Axle Co., North Detroit, Mich. (Internal Gear Drive.)

BALLS AND BALL BEARINGS.

Ahlberg Bearing Co., 2624 Michigan Ave., Chicago; 1790 Broadway, New York City; 805 Woodward Ave., Detroit.

Marburg Bros., Inc., 1790 Broadway, New York. (S. R. O.)

New Departure Mfg. Co., Bristol, Conn. (New Departure.)

Norma Co. of America, 1790 Broadway, New York City. (Norma.)

BODIES—WOOD AND METAL.

Springfield Metal Body Co., 20 Medford Ave., Springfield, Mass.

BOLTLESS AUTO SPRINGS.

Harvey-Spring Co., 851 17th Street, Racine, Wis.

BRAKE BANDING OR LINING.

Standard Woven Fabric Co., Framingham, Mass. (Multibestos.)

Staybestos Mfg. Co., Lena and Armat Sts., Germantown, Philadelphia, Penn. ("S-M-C," "Gilt-Edge" and "Universal.")

Thermoid Rubber Co., Trenton, N. J.

BRUSHES, WIRE.

Williams Foundry & Machine Co., Akron, O.

CABLE, AUTOMOBILE.

Faw, J. H., Inc., 41 Warren St., New York City. (Standard American.)

Packard Electric Co., The, Warren, O.

CARBON REMOVERS. (See Cylinder Cleaning Compound.)

CARBURETORS.

Zenith Carburetor Co., Detroit. (Zenith.)

CARS—GASOLINE PLEASURE.

Inter-State Motor Co., 804 West Willard St., Muncie, Ind. (Inter-State.)

Metz Co., Waltham, Mass. (Metz.)

Nordyke & Marmon Co., Indianapolis. (Marmon.)

Peerless Motor Car Co., Cleveland, O. (Peerless.)

Pierce-Arrow Motor Car Co., Buffalo, N. Y. (Pierce-Arrow.)

Reo Motor Co., Lansing, Mich.

Scripps-Booth Co., Detroit. (Scripps-Booth.)

S. J. R. Motor Co., 126 Massachusetts Ave., Boston, Mass.

Stutz Motor Car Co., Indianapolis. (Stutz.)

White Co., Cleveland, O. (White.)

Willys-Overland Co., Toledo, O. (Overland.)

Winton Co., 131 Berea Road, Cleveland, O. (Winton.)

CARS—GASOLINE COMMERCIAL.

Chase Motor Truck Co., 106 West St., Syracuse, N. Y.

Duplex Power Car Co., Charlotte, Mich. (Duplex.)

Federal Motor Truck Co., Junction and Leavitt Sts., Detroit. (Federal.)

Gramm-Bernstein Co., Lima, O.

Independent Motors Co., Port Huron, Mich. (Independent.)

International Motor Co., 64th St., and West End Ave., New York, N. Y. (Mack.)

Kissel Motor Car Co., 196 Kissel Ave., Hartford, Wis.

Locomobile Company of America, Bridgeport, Conn.

Packard Motor Car Co., Detroit, Mich.

Peerless Motor Car Co., Cleveland, O. (Peerless.)

Pierce-Arrow Motor Car Co., Buffalo, N. Y. (Pierce-Arrow.)

Reo Motor Co., Lansing, Mich.

Signal Motor Truck Co., Detroit. (Signal.)

Sullivan Motor Car Co., Rochester, N. Y. (Sullivan.)

White Co., Cleveland, O. (White.)

CARS—ELECTRIC COMMERCIAL.

Baker E & L Co., Cleveland, O.

General Vehicle Co., Long Island, N. Y.

CEMENTS.

International Metal Polish Co., Indianapolis, Ind.

CHAINS, TIRE AND ANTI-SKIDDING DEVICES.

American Chain Co., Inc., 28 Moore St., New York City. (Weed.)

CIGAR LIGHTERS. (See Lighters.)

COILS.

Heinze Electric Co., Lowell, Mass.

CONTROLLERS.

Pierce Speed Controller Co., Anderson, Ind.

CRANK HOLDERS.

King Specialty Mfg. Co., Brookline, Mass. (King.)

CYLINDER CLEANING COMPOUND.

Dyer Apparatus Co., Cambridge, Mass. (Oxy-Carbon.)

ELECTRIC LIGHTING EQUIPMENT.

Carleton Co., The, 171 Summer St., Boston. (New Carleton No. 68.)

Culver-Stearns Mfg. Co., Worcester, Mass.; Detroit.

Disco Electric Starter Corp., Detroit, Mich.

ELECTRIC TROUBLE SHOOTER.

American Bureau of Engineering, 1526 Wabash Ave., Chicago, Ill. (Ambu.)

ENGINES, GAS, GASOLINE, KEROSENE.

Manufacturers' Engine Company, Kansas City, Mo.

FILLOMETER.

Apex Electric Co., 1410 West 59th St., Chicago, Ill.

FIRE EXTINGUISHERS.

Pyrene Co. of N. E., 88 Broad St., Boston, Mass.

FORD HOODS AND RADIATORS.

Superior Lamp Mfg. Co., 136 W. 52nd St., New York, N. Y.

FORD STARTERS.

Hunter Auto Supply Co., Hunter Bldg., 333 W. Madison St., Chicago, Ill. (Hunter.)

Picard, A. J., & Co., 1720 Broadway, New York City. (Genemotor.)

Walden Mfg. Co., 78 Commercial St., Worcester, Mass.

FOUR WHEEL DRIVE.

Four Wheel Drive Auto Co., Clintonville, Wis.

FUNNELS, AUTO.

Dover Stamping & Manufacturing Co., Cambridge, Mass. (Dover.)

GARAGE COMPRESSOR.

Jacobson Mch. Mfg. Co., Warren O. (Mascot.)

GAS ENGINES.

Manufacturers' Engine Company, Kansas City, Mo.

GASOLINE ENGINES.

Manufacturers' Engine Company, Kansas City, Mo.

GASOLINE PUMPS.

Wayne Oil Tank and Pump Company, 2 Canal Street, Ft. Wayne, Ind.

GEAR SETS.

Detroit Radiator Specialty Co., 961 Woodward Ave., Detroit, Mich.

GEARS, STEERING.

Ross Gear & Tool Co., 794 Heath St., Lafayette, Ind. (Ross.)

GENERATORS.

Carleton Co., The, 171 Summer St., Boston. (New Carleton No. 68.)

HEATERS.

Superior Mfg. Co., N. E. Pittsburg, Penn. (Superior Safe Garage.)

HORNS.

Faw, J. H., Inc., 41 Warren St., New York City. (Ciero.)

Fitzgerald Mfg. Co., 101 Oliver St., Torrington, Conn. (Ciero.)

Selss Mfg. Co., 444 Dorr St., Toledo, O.

HOSE CLAMPS.

Faw, J. H., Inc., 41 Warren St., New York City. (Ideal.)

IGNITION ASSEMBLIES.

Faw, J. H., Inc., 41 Warren St., New York City.

INSULATION.

Packard Electric Co., The, Warren, O.

JACKS.

Motor Specialties Co., Waltham, Mass. (Excel Auto.)

KEROSENE ENGINES.

Manufacturers' Engine Company, Kansas City, Mo.

BUYERS' REFERENCE and GUIDE—Continued.**LAMPS.**

Faw, J. H., Inc., 41 Warren St., New York City.
 Mabey's Electric & Mfg. Co., Indianapolis (Mabey's Electric Trouble.)
 Mueller & Co., R. S., 431 High Ave., S. E., Cleveland, O. (Clamp.)

LIGHTERS, CIGAR.

Mabey's Electric & Mfg. Co., Indianapolis. (Mabey's Electric.)

LIGHTING SYSTEMS, ELECTRIC.

Carleton Co., The, 172 Summer St., Boston. (New Carleton No. 68.)

Faw, J. H., Inc., 41 Warren St., New York City. (Culver Stearns.)

Hawthorne Mfg. Co., Inc., 5 Spruce St., Philadelphia, Penn. (Spotlights, Marine Searchlights, Pencil Flashlights.)

Xcel-O-Lyte Co., 1200 Xcelo Bldg., New-ten, Ia.

LIGHT PROTECTORS.

Faw, J. H., Inc., 41 Warren St., New York City. (Lennon.)

LUBRICANTS.

Dixon Crucible Co., Jos., Jersey City, N. J. (Graphite.)

Eagle Oil & Supply Co., 104 Broad St., Boston. (Eagleline No-Karbon.)

New York & New Jersey Lubricant Co., 165 Broadway, New York. (MotoRol, Non-Fluid, Kejex.)

Standard Oil Co., New York. (Polarine.)

Texas Company, 17 Battery place, New York City. (Texaco.)

Valvoline Oil Co., 27 State St., Boston. (Valvoline.)

MAGNETO COVERS.

Helnze Electric Co., Lowell, Mass.

MAGNETOS AND SUPPLIES.

Bosch Magneto Co., 204 W. 46th St., New York.

Elsemann Magneto Co., 32 33d St., Brooklyn, N. Y. (Elsemann.)

Marburg Bros., 1790 Broadway, New York. (Mea.)

Splitdorf Electrical Co., 98 Warren St., Newark, N. J.

MAILING LIST.

Trade Circular Addressing Co., 166 W. Adams St., Chicago.

MANIFOLDS. (Intake and Exhaust)

Wilmo Co., 208 So. La Salle St., Chicago, Ill.

MEASURES.

Dover Stamping & Manufacturing Co., Cambridge, Mass. (Auto and Savol.)

MOTORS.

Buda Co., Harvey, Ill.

Waukesha Motor Co., Waukesha, Wis.

Wisconsin Motor Mfg. Co., Milwaukee, Wis.

OIL SPECIALTIES.

Boston Blacking Co., Boston, Mass.

PAINTS.

Boston Blacking Co., Boston, Mass.

PISTON RINGS.

Featherweight Piston Company, 11 Guyman Way, Pittsburg, Penn.

McQuay-Norris Mfg. Co., Dept. D, St. Louis, Mo. (Leak-Proof.)

PISTONS, ALUMINUM ALLOY.

Featherweight Piston Co., 11 Guyman Way, Pittsburg, Penn.

POLISHES.

International Metal Polish Co., Indianapolis, Ind.

PRESSES. (See Arbor Presses.)**PUMPS, GASOLINE.**

Wayne Oil Tank and Pump Company, 2 Canal Street, Ft. Wayne, Ind.

PUMPS, VALVE.

Hill Pump Valve Co., Chicago, Ill.

RADIATOR CEMENT. (See Cements.)

RADIATOR & HOOD COMBINATIONS.

Superior Lamp Mfg. Co., 136 W. 52nd St., New York, N. Y.

RADIATORS.

Rome-Turney Radiator Co., Rome, N. Y. (Helical Tube.)

REAMERS.

Harding Distributing Co., Boston. (Martell Aligning.)

REBORING CYLINDERS.

Motorcycle Accessories Co., St. Paul, Minn.

RINGS. (See Piston Rings.)**ROAD BUILDING MATERIALS.**

Barrett Manufacturing Co., New York. (Tarvia.)

ROLLER BEARINGS.

Hyatt Roller Bearing Co., Detroit. (Hyatt.)

Norma Co. of America, 1790 Broadway, New York City. (Norma.)

SELF-STARTERS. (See Motor Starters.)

SHOCK ABSORBERS AND SUPPLEMENTARY SPRINGS.

Hartford Suspension Co., 147 Morgan St., Jersey City, N. J.

SPARK PLUGS AND IGNITERS.

Bosch Magneto Co., 204 W. 46th St., New York.

Faw, J. H., Inc., 41 Warren St., New York City. (Red Seal.)

Gibson-Hollister Mfg. Co., Boston, Mass.

Hartford Machine Screw Co., 512 Capitol Avenue, Hartford, Conn. (Master.)

Helnze Electric Co., Lowell, Mass.

Milwaukee Auto Specialty Co., 705-711 Chestnut St., Milwaukee, Wis. (Centerfire.)

Splitdorf Electrical Co., 98 Warren St., Newark, N. J.

SOAPS.

International Metal Polish Co., Indianapolis, Ind.

SPEEDOMETERS.

Standard Thermometer Co., Boston, Mass.

SPRINGS FOR AUTOMOBILE SUSPENSION.

Marburg Bros., Inc., 1790 Broadway, New York. (Marburg-Hagen.)

Tutthill Spring Co., 756 Polk St., Chicago. (Titanic Unbreakable.)

TEST CLIPS.

Mueller & Co., R. S., 431 High Ave., S. E., Cleveland, O. (Universal.)

THERMOS CASES.

Dover Stamping & Manufacturing Co., Cambridge, Mass.

TIMERS.

Motor Specialties Co., Waltham, Mass. (Bemus.)

TIRE CHAIN GRIPS. (See Chains.)

TIRE PUMPS.

Detroit Motor Acc. Mfg. Co., 975 Woodward Ave., Detroit, Mich. (Gearless Motor Driven.)

TIRE REPAIR OUTFIT.

C. A. Shaler Co., 252 Fourth St., Wau-pun, Wis.

TIRES, CASINGS AND INNER TUBES.

Federal Rubber Mfg. Co., Milwaukee, Wis. (Federal.)

TOPS AND ATTACHMENTS.

Springfield Metal Body Co., 20 Medford Ave., Springfield, Mass.

TRACTORS.

Knox Motor Associates, Springfield, Mass. (Knox.)

TRANSFORMERS.

Packard Electric Co., The, Warren, O.

TRUCKS AND TRACTORS. (See Cars, Commercial.)

VALVE GRINDING COMPOUND.

Faw, J. H., Inc., 41 Warren St., New York City. (Eureka.)

VARNISHES

Boston Blacking Co., Boston, Mass.

VULCANIZERS.

Mabey's Electric & Mfg. Co., Indianapolis. (Mabey's Electric.)

Vanderpool Co., Springfield, O.

Williams Foundry & Machine Co., Akron, O.

WARNING SIGNALS.

Seiss Mfg. Co., 444 Dorr St., Toledo, O.

WELDING OUTFITS.

Dyer Apparatus Co., Cambridge, Mass. (Dyer.)

Prest-O-Lite Co., Indianapolis, Ind.

Searchlight Co., 1012 Karpen Bldg., Chicago, Ill.

Waterhouse Welding Co., 3 Pelham St., Boston, Mass.

WRENCHES AND COMBINATION OUTFITS.

Coes Wrench Co., Worcester, Mass.

Faw, J. H., Inc., 41 Warren St., New York City. (Walden.)

Lane, Will B., 180 No. Dearborn St., Chicago. (Unique Ratchet.)

Mosesberg Co., Frank, Attleboro, Mass.

Walden Mfg. Co., 73 Commercial St., Worcester, Mass.

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William H. Black, Treasurer.
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Published the 10th and
25th of Each Month.
Ten cents a copy.

D. O. Black, Jr., Secretary.
Times Building, Pawtucket, R. I.

Entered as second class matter, April 15, 1906, at the Postoffice at Pawtucket, R. I., under Act of Congress of March 3, 1879

VOL. XLI.

FEBRUARY 10, 1916.

NO. 1.

PUBLISHER'S AND READERS' PAGE.

THE Publisher Wishes to call the attention of subscribers again to the necessity of sending with their complaints of non-receipt of copies of The Automobile Journal the receipts they receive from the subscription solicitors. This caution applies particularly to new subscribers and to this season of the year, when a large number of subscriptions are taken at the automobile shows. Another caution to bear in mind is to look over the solicitor's slip to make certain that the correct address, the correct spelling of the name, and the name of magazine are given. This precaution will save in many instances considerable trouble both in this office and among the subscribers.

The Boston Show managers advise one month before the opening of the exhibition that 107 exhibitors of pleasure cars and commercial vehicles and scores of accessory makers had been awarded space in Mechanics and Paul Revere halls. These figures indicate that the show will be the largest of the present season, and the Feb. 25 issue of The Automobile Journal, the Boston Show Number, will show why it is the largest and why it is the most important held in any section of the country. Among the many special feature articles scheduled for that issue is one that will contain information which every visitor at the show should have. This data will not only simplify the matter of viewing all the major exhibits, but will prove a valuable permanent reference library, which will be referred to many times during the season. The Publisher expects an unusually large demand for the

show number, and consequently urges that those who desire copies send in their applications at once.

A Distinguishing Feature of no small moment of the Boston Show Number will be its appearance in

its increased size for the first time. One of the questions put forward when the matter of increasing the size of the magazine was first projected was, will the subscribers and advertisers approve? Every apprehension on that score has been swept away by the large volume of letters from both classes, in which the Publisher is commended for his decision. The writers unanimously agree that the magazine will be more attractive, and that the increase of size will provide more space in each issue for better illustrations and more feature articles. The first article in this issue is an example of the constructive editorial policy to be followed, the Editor believing that the subscribers are interested in the matter of eliminating the danger of road travel due to dazzling headlights.

The Correspondence with the Reader Department is one of the most popular and serviceable of the magazine, as is shown by the large number of answers printed in

this issue. Even though more space than usual is devoted in this number, it was not possible to publish answers to all the inquiries received. Such answers have been sent direct. This is not meant to curb inquiries. When asking questions be specific in all details relating to parts involved in the question.

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Announcement.

BEGINNING with the February 28 advance Boston Show Number, The Automobile Journal will be increased to a larger and more attractive page size. It will have the standard type page of 7¼ by 10 inches and a full page 9 by 12 inches.

The show edition offers a fitting opportunity to make this change. Journal subscribers will receive one of the best numbers in quality, and advertisers one of the greatest editions in quantity, that has ever been mailed from this office.

The 1916 Boston Show will be even more comprehensive this year than formerly. It will be the largest showing of passenger cars, commercial cars, parts and accessories ever held in America.

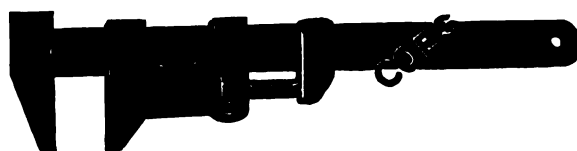
Last Form Will Close Feb. 25.

AUTOMOBILE JOURNAL PUBLISHING CO.

Times Building

Pawtucket, R. I.

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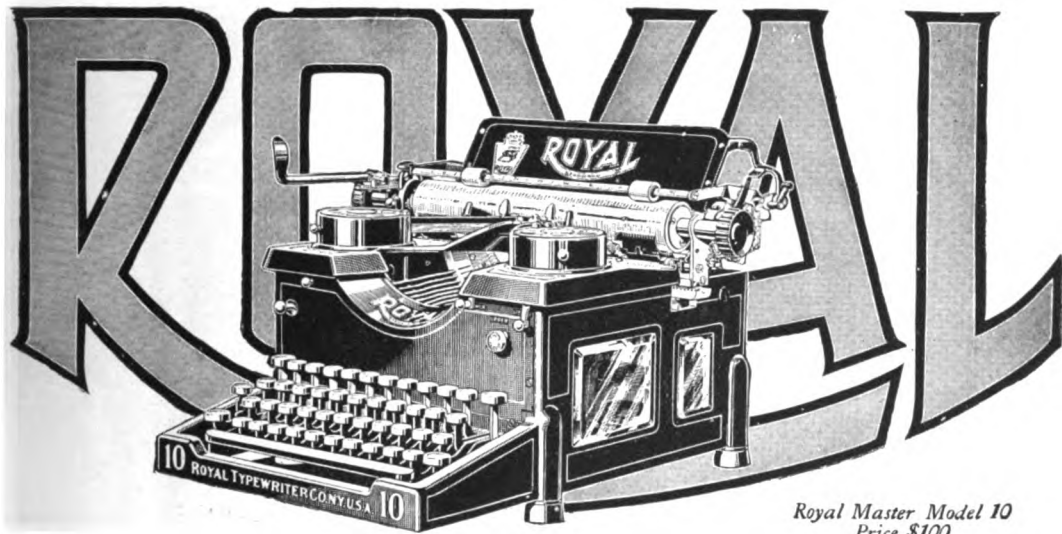
COE'S Special Automobile Model is a perfect tool. The jaws are hardened special quality tool steel to withstand hard usage, and the handle is long to afford great leverage. The wrench is thin to work in space inaccessible for ordinary wrenches.

Coe's Special Automobile Model wrench is a tool kit in itself. Coe's quality costs slightly more, and it is worth many times the price of any other tool. A Coe's is always dependable, in the garage or on the road. Literature sent at request.

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That small but comfortable car—fully equipped and perfectly appointed—

That light but amply powerful low-upkeep, inexpensive-to-operate car.

It has a 20-25 horsepower four cylinder en bloc motor.

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The finish is lustrous black with nickel and polished aluminum trimmings.

And it has the beautiful Overland lines—full streamline body with beautifully curved cowl.

It is a car of every convenience—abounding comfort—beautiful appearance—one to be proud of in every way.

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Automobile Journal



THE regulations prohibiting the use of glaring headlights adopted by the Massachusetts Highway Commission and approved by the governor's council, have been in force some weeks. They are likely to have great influence on the headlight situation all over the country. They have been approved practically as they stand by the Society of Automobile Engineers and the National Automobile Chamber of Commerce for adoption everywhere.

Officials from other states have given the regulations a great deal of attention and it is very probable that they will form the basis of headlight laws that will be passed in many states. For this reason the Massachusetts headlight regulation and the conditions it has created in that state are of great interest to all motorists, principally because they are likely soon to find themselves in the same situation.

What the Rule Demands.

Briefly, the regulation requires that the headlights at all times throw enough light ahead to show all persons, cars or substantial objects in the road at a maximum distance of 150 feet. The light must not throw dazzling rays that will be more than $3\frac{1}{2}$ feet from the ground 50 feet ahead, and yet the light must leave the lamps at an angle of 45 degrees sidewise so that a person 10 feet to

one side and 10 feet ahead will be visible.

This regulation was adopted after exhaustive tests had been made by the highway commission of many styles and kinds of devices. It follows that the commission must have been satisfied that devices were available that would meet the requirements.

No Explanation Given.

After promulgating the order it did not, however, offer any information as to devices that it had tried and found to be effective, and it has announced that no information which would aid the motorist to pick out a satisfactory device will be given. Its refusal is, of course, based on the desire to avoid the controversy into which it would immediately be plunged by manufacturers who would feel that its judgment injured their interests.

Naturally there has been much doubt and uncertainty among motorists who have thus been left to judge for themselves whether or not their lights would be acceptable to the police under the new regulation.

The Massachusetts Automobile Club took up the problem of enlightening its members. On one of the floors of its garage it arranged a shadow box the width of the standard Massachusetts highway and laid out 150 feet of road, which was covered with black tar paper to reproduce as nearly as possible the conditions that would be present on a macadam road.

Standards were set up on which headlights of both gas and electric types were mounted at the same distance from the ground that they would be if they were in use on a car. Dummy figures

350677

of men were set up 10 feet in front of the lights and 10 feet to one side.

No Definite Report.

It was intended at first, in order to assure a definite outcome of the tests, that an expert from Philadelphia, another from New York and a third from the faculty of the Massachusetts Institute of Technology should observe the tests and select those devices that met the conditions.

Legal counsel, however, informed the club that such a determination, being unofficial, might make the club liable for damage done the business of any maker of anti-glare devices who was dissatisfied with the results. Consequently that feature of the programme had to be abandoned.

Thirty-three devices of various kinds were gathered in the open market. Members of the club were asked to be present, to observe the tests and to come to their own conclusions concerning the results yielded by the different dimmers.

Judges of the courts and police and highway officials who will have a part in enforcing the regulation were invited on another occasion. And a third session was held at which chauffeurs, dealers in supplies and repair men were given an opportunity to see the tests.

These tests were carefully worked out by Superintendent Chamberlin of the club shops and the cost for the three exhibitions was nearly \$1200. As a result of them the club members came to an understanding of what could be accomplished by the various dimming devices.

There was an element of uncertainty in the results, however, as, notwithstanding the standards of measurement that are given in the highway regulation, there is still some uncertainty regarding what will or will not be considered glare.

Experts Were Present.

Otto Luyties of New York, an expert on lenses, discussed the technical problems involved and showed that whether or not frosted lenses or those of various prismatic projections were used, the glare or lack of glare, was still largely a matter of the way in which the lamps were focussed.

Lewis H. Stern of Philadelphia, an expert on reflectors, discussed that phase of the problem. The control of the main beams of light so that they will fall as required by the highway regulation was found not to be difficult, but in spite of the most careful focussing and the most serviceable prismatic lens, it is impossible on some lamps to avoid a small spot of glare even on a frosted lens.

The reason for this is that it is impossible to

make in a commercial way a parabolic reflector so perfect in contour that the light can be perfectly controlled. This point was made clear to the officials when they attended the test.

The question is still undecided as to whether this slight glare will be regarded as glare under the law. This point will come up in court when the police make a number of arrests under the regulation. Massachusetts motorists will then know definitely what is to be expected.

The Value of Focus.

It was also found that with a lamp of certain design it is possible to prevent glare by focussing and without the aid of ground glass or prisms. On most cars this involves bending the lamp standards slightly so that the lamp will point downward and some careful work has to be done in fixing the bulb in the reflector.

While no result of the club tests was made public, an examination of the cars in the club garage and of the devices used on them would indicate the conclusions of individual members as to which devices satisfactorily met the requirements.

There are on the cars used by members a number of Haskins lenses, some full frosted types and a partly frosted kind known as the "human eye." The Osgood lense with projecting prisms and corrugations on the exterior surface was used on many cars. Some had merely full frosted front glasses, some half frosted. Some used the Johns-Manville glass, which is frosted except for a "U" shaped space at the bottom.

Examples were noticeable also of the Perrin dimmer, which consists of a metal shield placed over the bottom of the electric light bulb and held in place by slipping over the sharp glass projection at the front of the bulb. Lancaster lenses of the fully diffused and semi-diffused type were found to be in use. Rexlight, a metal shield that goes under the bulb and between it and the reflector, was in use.

Many Principles Are Employed.

There is an infinite variety of different devices offered for this purpose. There is every kind and type of treatment for the bulb, and for the lense, not to mention the reflector. The principle on which many of them work is to intercept the light that would naturally be thrown upward from the lamp either before or after it reaches the reflector. Others using the prismatic principle seek to retain this light while they change its direction, pointing it upon the road instead of suppressing it entirely. Others diffuse the upward bound rays while they do not interfere with the concentration of those pointed upon the road.

The various dimming devices on the market can be grouped in three broad classifications—devices or processes intended to be applied to the headlight lens or bulb, devices intended to allow the driver to dim the intensity of the light from his compartment by cutting into the lighting current, and those protectors designed to be placed on the windshield to moderate the glare from the headlight of an oncoming car. In the first classification are the following:

LENNON PROTECTOR.

The Lennon Light Protector is a brass shield in one piece that fits over the underside of the lamp bulb and is held in place by the projection of glass on the front of the bulb, which is inserted in a hole in the protector. The metal will spring sufficiently to fit slightly oversize bulbs. It is designed to intercept the rays that would naturally be thrown against the lower part of the reflector and be projected upward from the lamp. It is distributed by J. H. Faw, Inc., 41 Warren street, New York City.

MONARCH DIMMER.

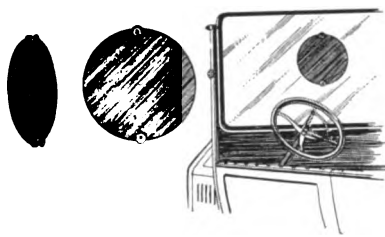
Monarch Adjustable Auto Lamp Dimmers are in the nature of hoods made of dull black tough fabric fitted over the outside of the headlight and held in position by coil springs. As seen in the accompanying illustration they cover a half of the lens, and can be adjusted to either cover the top or the bottom as desired. The manufacturer directs attention to their neat appearance. Manufactured by the Monarch Carriage Goods Company, 2838 Spring Grove avenue, Cincinnati, O.

LANCASTER LENS.

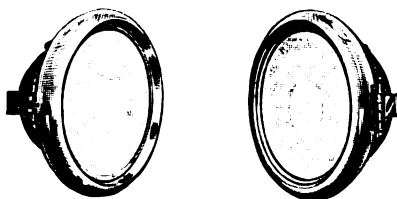
The Lancaster Safety Lens is a special lens made with deep, circular corrugations, which do not dimin-



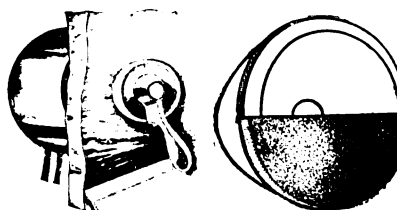
Amco Auto Light Deflector.



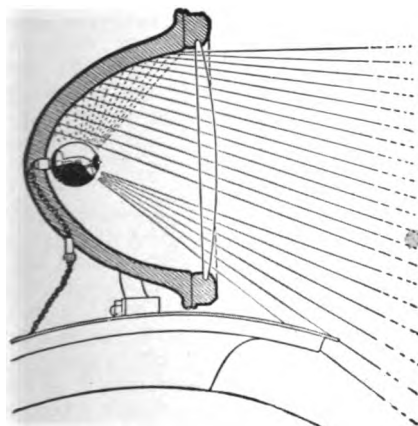
Jones Amber Glare Shield.



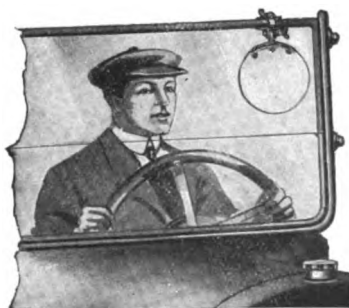
Monarch Headlight Dimmers for Gas and Electric Lights.



Chaney Headlight Dimmer (at Left); Monarch Adjustable Lamp Dimmer.



Perrin No-Glare Attached.



Staude Glare Stopper.

ish the volume of the light, but do diffuse it. It is designed to throw a brilliant white light on the road immediately in front of the car, but not so as to blind approaching drivers. The company makes a fully diffusing type, and a semi-diffusing kind that leaves about half of the glass transparent. Another type is a frosted star lens. Manufactured by the Lancaster Lens Company, Lancaster, O.

KNO-GLARE BULB.

The Mac Kno-Glare lamp bulb is a lamp so made that the light cannot penetrate its lower side or a spot in the centre. It is designed to prevent the rays being thrown on the lower part of the reflector and upward. The principle is similar to that of the metal lamp guards. The Mac Kno-Glare bulb, however, is treated by process. It is manufactured by the Mac Manufacturing Company, 118 East Jefferson street, Syracuse, N. Y.

KLEARGLOW.

Klearglow is a special lens with concentric corrugations partly frosted and partly clear. It is claimed for the lens that it removes all glare, while it retains the strength of the light undiminished and sufficiently strong for country driving. It is manufactured by H. G. Paro, Michigan building, Chicago, and is moderately priced.

H-M RAY CONTROLLER.

In the H-M Ray Controller, which is a special lens, the top for little more than half the area is so treated that it will diffuse the strong rays thrown upward, while the lower part is unimpeded by the clear glass below. It is made by the H-M Manufacturing Company, 189 Public street, Providence, R. I.

PERRIN NO-GLARE.

The Perrin No-Glare device consists



Osgood Deflector Lens.

of an aluminum shield which fits about base and the under part of the lamp bulb and a second piece with a hole in it that fits over the lamp tip and is attached to the main part of the shield by light springs. It is designed to prevent light being thrown upward by intercepting the rays which would strike against the lower half of the reflector. The device has been approved by police officials of many cities and about 150,000 of them are now in use. It is produced by license under the Myers patents which a federal judge recently held covered all types of shields that fit about the electric bulb and also of coating the bulb so that parts of it are impervious to light. No-Glare is manufactured by the Perrin Manufacturing Company, Detroit, Mich.

MONARCH HEADLIGHT DIMMERS.

A dimming device made for both electric and gas headlights is the Monarch Headlight Dimmer. They are easily placed behind the lens on electric lights and in front on gas lights. There is a transparent opening in the centre to let out the full power of the light, while outside of this circle the light is diffused and the glare eliminated. The manufacturer advises that they have been approved by the Chicago authorities. Distributed by the Distributors and Manufacturers Company, 82 West Washington street, Chicago.

ANTI-DAZZLE.

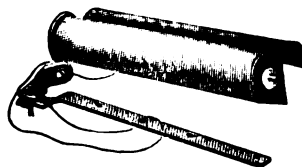
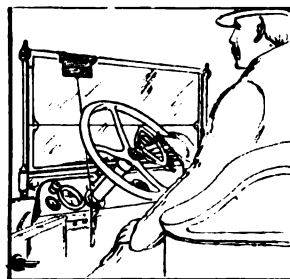
Anti-Dazzle is a quick drying liquid for producing frosting on the glass and when applied to the lens it is said to diffuse the light without cutting down its quantity appreciably. The maker declares that it will not rub off. Manufactured by the Hall-Thompson Company, Hartford, Conn.

OSGOOD DEFLECTOR LENS.

Osgood Deflector Lens are one-piece specially molded prismatic lens, designed and made on optical principles to cast the light by deflection on to the road below the level of the eyes of approaching car drivers. Its construction is shown in an accompanying illustration. The distributor declares that the police of every city where it has been shown have indorsed it. Made by the Osgood Lens and Supply Company, 339 Wabash avenue, Chicago, and distributed in the East by the Atwood Auto Lamp Company, Park square, Boston, Mass.

AMCO DEFLECTOR.

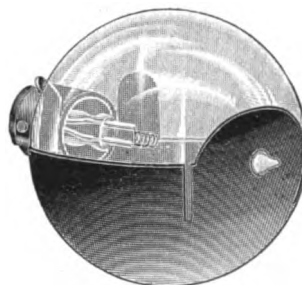
The Amco Auto Light Deflector is a hemispherical metal shell enamelled with a dead white finish. It snaps on to the shank of the bulb. This white surface tends to soften and neutralize the glare of the main reflector and sets up no counter glare, which makes it possible to obtain the desired results by covering only half the light source. Manu-



Reynolds Safety Light Shade.



Klearglow Auto Light Diffuser.



Lennon Light Protector.



Launcester Diffusing Lens.

factured by the Art Metal Manufacturing Company, East 61st street and Curtiss avenue, Cleveland, O.

CLARK DIMMER.

The Clark Dimmer is a horizontal cone shaped hood that fits snugly over the outside rim of the headlight, it being held in position by an expansible material. The dimming portion is made of pyralin, which is weather proof and durable. The rays coming in contact with the dimming element are instantly diffused in all directions. There is a seam through the device which allows it to be collapsed flat enough to be carried in the pocket or under the seat cushion. They are made to fit all sizes of headlights. Manufactured by Cherry-Clark Guard and Dimmer Company, 115 Dearborn street, Chicago.

The following descriptions apply to that class of dimming devices designed to allow the driver to moderate the intensity of the light from the driving compartment by decreasing the supply of current.

CHANNEY DIMMER.

The Chaney Automobile Headlight Dimmer enables the driver to graduate the intensity of the light to high, medium and low. It is designed to be installed on the dash and to be operated either by hand or the foot. Complete control of the headlights is had at all times. The maker declares that it is easily installed by anyone. Manufactured by the L. F. Chaney Company, Springfield, O.

STA-RITE DIMMER.

The Sta-Rite Dimmer Switch is inserted in the wiring system of the car and introduces additional resistance which cuts down the intensity of the light rays to dim them temporarily for driving in the city or while passing a car on the road. The switch is made for six, seven, 12 or 14-volt bulbs, and in single button type for use between the switch already installed and the bulb, and in two, three or four-button designs. The two-button style is commonly used for headlights only, or also in connection with tail lights. The manufacturer declares that when the dimmer is used the volume of the light is cut down from 60 to 70 per cent. Manufactured by Frank W. Morse, 516 Atlantic avenue, Boston, Mass.

DIMIT.

Dimit is both a dimming switch and a protector of lamps. It is installed in the wiring system in the conventional way, the switch being located on the dash or any other place desired. It is a four-way device. On first button at the left the lamps are switched off; on second, they burn with full brilliancy; on the last two the lights burn dimly. Its protective value is in that it holds back the

high voltage and will not allow excessive current to pass through the lamps on starting, stopping and high speed. Manufactured by the Suburban Lighting Company, Summit and Lagrange streets, Toledo, O.

There are several devices on the market that afford protection to the drivers of cars approaching those with blinding headlights.

GLARASCOPE.

The Glarascope is a circular shield of green translucent celluloid, through which the driver can peer at the oncoming car without being blinded and can look past the Glarascope at the stretch of road. There are two models, one for when the windshield is up and one for when it is down. In both the shield fastens to the glass by rubber vacuum cups, there being one on the last mentioned and three on the arm extension of the other. Manufactured by the Randall-Faichney Company, 76 Atherton street, Jamaica Plain, Boston, Mass.

AMBER GLARE SHIELD.

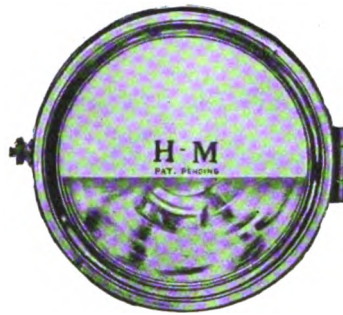
The Amber Glare Shield differs from the Glarascope in that it attaches to the windshield by two rubber suction cups. Its color is amber. Manufactured by the Jones Auto Company, Broadway, at 25th street, Oakland, Cal.

STAUDE GLARE STOPPER.

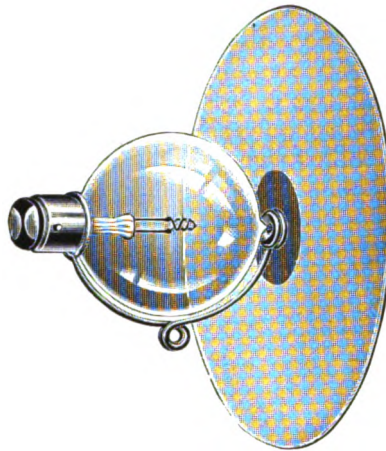
The Staude Glare Stopper is a heavy clear amber crystal lens glass fitted with a nickel adjustable joined arm by which it is attached to the windshield. It can be used on any type of windshield and can be adjusted to any of the positions to which the windshield may be adjusted. The jointed arm allows it to be moved when washing the glass, or for any other purpose. Manufactured by the E. G. Staude Manufacturing Company, 2675 West University place, St. Paul, Minn.

REYNOLDS SHADE.

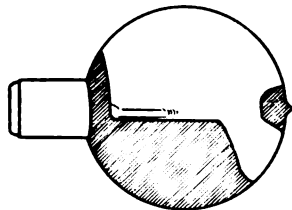
The Reynolds Safety Light Shade



H-M Headlight Ray Controller.



Mel-O-Lite Headlight Filter.



Mac Kuo-Glare Lamp Bulb.

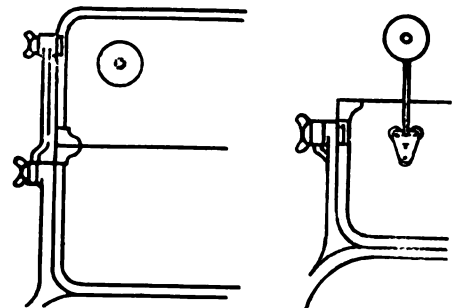
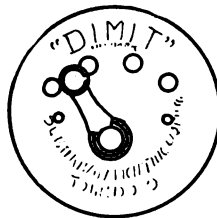
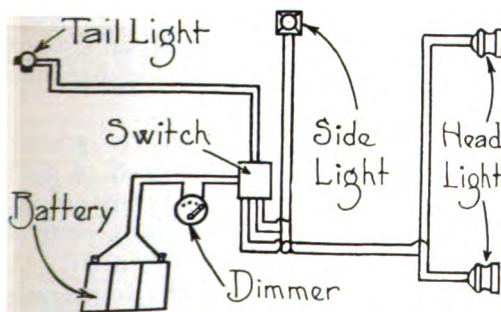
resembles a miniature window shade and has a metal container fastened to the frame of the windshield into which the shade rolls up when not in use. Both the container and the shade are inconspicuous. A cord runs from the bottom of the shade to a small pulley on the bottom of the frame and to a lever by which the shade is raised or lowered. The accompanying illustration shows its construction and method of operation. It is manufactured by the Reynolds Safety Light Shade Company, Oneida, N. Y.

MEL-O-LITE.

Mel-O-Lite headlight filter consists of a disc of frosted translucent pyralin, with a green or orange centre, that is fitted to the shank and tip of the bulb and between it and the lens. It is designed to intercept the dazzling rays and to "mellow" them without reducing the volume appreciably. It can be attached or detached instantly. The manufacturer submitted this device to the Chicago police authorities, who approved it as meeting with the requirements of that city, which are similar to the regulations of other large cities. Mel-O-Lite headlight filters are manufactured by the Chicago Eye Shield Company, 134 South Clinton street, Chicago, Ill.

MAGNETO LAMP REGULATOR.

The Jefferson Magneto Lamp Regulator is a transformer coil which is set in the magneto circuit of a Ford car to step down the current to a lower voltage and increase the amperage. It is used with either four or six-volt current circuits, the former being used as a dimmer. The latter is designed as a dual system, the regulator being interchangeable with a six-volt battery. The battery is used when the car is idle, and the regulator when the car is driven. However, each is operated independent of the other. It is manufactured by the Jefferson Electric Manufacturing Company, 851 Harrison street, Chicago, Ill.



Wiring Diagram Showing Installation of the Dimit (Two Sketches at Left); Two Types of the Glarascope Mounted on Windshields.

CLAYDEN HEADS S. A. E. COMMITTEE.

THE council of the Society of Automobile Engineers met at the Chicago Automobile Club during the Chicago show and appointed heads of important committees. K. W. Zimmerschied, who did excellent work as head of the standards committee, the most important body in the organization, is unable, owing to pressure of other work, to continue in that position during the coming year, and A. L. Clayden, a British engineer, who is now an American motor trade journalist, was appointed to the position. Last year he served as chairman of the foreign co-operation division of the committee.

At the same time George W. Dunham of Detroit was made chairman of the meetings committee, which secures and passes upon the papers that are read at the various meetings. Vice President R. H. Combs of Indianapolis will serve as head of the membership committee. The publication committee will be headed by Herbert Chase.

HYATT MILEAGE PRIZE AWARDED.

F. E. Slason, Plainville, Kan., has been awarded the first prize in the contest conducted by the Hyatt Roller Bearing Company for the owner of the car in which the original Hyatt bearings had travelled the largest number of miles. Slason's car, a 1909 Buick, had travelled 261,000 miles—a distance equal to more than 10 times around the world—up to the time the contest closed last October.

The second prize was awarded to James Lewis, Shelton, Conn., whose 1909 Mitchell had travelled 218,724 miles. Seven different makes of cars were represented among the 16 prize winners. Several Fords were included.

The total distance travelled by the 16 cars was 2,512,435 miles, an average of 156,814 miles. All are still in operation. The judges were Alfred Reeves, general manager of the National Automobile Chamber of Commerce; Coker F. Clarkson, general manager Society of Automobile Engineers, and Julian Chase.

MRS. VELIE GIVES AMBULANCE.

The American Red Cross Society has received from Mrs. W. L. Velie, wife of the president of the Velie Motor Vehicle Company, Moline, Ill., a new ambulance, to be used in the European war. The

exterior is gray with the red cross on the sides and has much black enamel and nickel trimmings. The interior is finished in white, is thoroughly sanitary and is light and airy. Four patients with their attendants can be carried. Access may be had through front and rear windows. The Rock Falls Manufacturing Company, Sterling, Ill., made the body, which is mounted on a Velie six chassis. It has a wheelbase of 150 inches. The cost of the car is about \$5000. It will be in service on one of the fronts in about 30 days.

CHALMERS RAISES SIX PRICE.

The price of the larger of the Chalmers six, the "Six 40," has been increased to \$1450, which is the amount that was asked for it when it was first announced. This increase is defended on the ground that during the past few months aluminum has increased from 19 cents to 53 cents a pound, copper has risen from 14 cents to 24 cents, vanadium steel, which a year ago brought \$1.85, now sells for \$8.50. High speed steel formerly \$1.05 per pound, is now \$3.35. Leather formerly 20 cents a foot, is now 33 cents. It now costs for material \$118.22 more to build the car than it did a short time ago. This amount is claimed to be in excess of the company's net profit per car. The car will be sold at the old price up to midnight Feb. 29, but thereafter it will be \$1450.

SCRIPPS-BOOTH TO TREBLE.

A year of unexampled success for the Scripps-Booth company finds that concern enlarging its plants and preparing for an increase of its volume to three times its present size. Nearly \$700,000 worth of cars were shipped to Europe during the first year in addition to a big business being developed in the United States.

The line for 1916 will continue the present two-passenger roadster at \$825, instead of \$775, and there will be in addition a four-passenger touring car of equally distinctive lines with an eight-cylinder motor. A model called "La Vitesse" will be built and sold with a guarantee of 70 miles per hour for those who are interested in speed.

CHICAGO SHOW WAS VERY SUCCESSFUL.

**More Dealers Present Than at New York and 282,396 Persons Saw the Show—
Several New Car Models Were Shown.**

OWING to its central location and the fact that it is the most easily reached of the two great national shows for the majority of motor car dealers, the Chicago automobile show this year equalled in importance, if it did not exceed, the New York display.

Early in the week more than 12,000 dealers from all over the Middle West, the South and far West were registered. Some of these came in special trains and took occasion at the same time to visit the factories of the companies they represent. Thus a party of 150 dealers left Minneapolis. They all sell Overland cars and the train was decorated with great Overland signs. They visited the factory in Toledo and returned to Chicago in time for the opening of the show. Another similar party came from Texas and there were scores of others from points not so distant.

Companies of all sorts as well as every variety of organization took advantage of the great gathering of men interested in the trade to hold conventions and banquets.

In view of the large number of dealers in attendance the factories had an exceptionally large number of travelling representatives present to take care of their wholesale selling. Many of the visiting dealers from points nearby kept in touch with the booths of their companies to take care of any prospects from their own territory who might put in an appearance.

Four Buildings Required.

As has been the case for several years, the show was entirely too large to be housed in any one building, even though the space provided in the Coliseum is very large. Four structures were used this year, the Coliseum, its Annex, the adjoining Greer building and the First Regiment Armory across the street. Checks were issued to

permit the holders to pass from the main show to the Armory.

The exhibits were as complete as those at New York—more complete perhaps, since several manufacturers who did not have their products ready for the New York show were able to put them on display at Chicago. Practically every car and every device known to the industry was shown there.

Among the things that had not been seen at New York was very little that was unusual and peculiar. Nearly everything was practical. In the accessory division one of the most interesting new exhibits was a tire pump on the new Cham-



General View Looking Down the Main Aisle of the Chicago Coliseum, Where the Best of the Japanese Decorations Were Shown—It Has Been Estimated That 282,396 Persons Thronged This Aisle During the Week.

pion model for inflating the tires while the car is in motion. The Shattuck trailer carries an outfit which can be converted into a completely equipped hunting camp. It can be hauled easily behind the car. The Pierce Speed Controller Company demonstrated a vacuum brake.

Perhaps the exhibit that was most surprising and created the greatest interest was a new light six-cylinder model offered by the Cole Motor Car Company at \$1095. It had been generally believed that during the next year the Cole company would confine itself to eight-cylinder cars.

New Cole Light Six.

The body is the typical Cole design. It has a 120-inch wheelbase and 34 by four Firestone tires. The body, like the Cole Eight, is of the aisleway type with double cowl and disappearing auxiliary seats, for it is a seven-passenger model. It has a Reutenber motor, Warner gearset, Heinze-Springfield electric lighting and starting system and Stromberg carburetor.

The new Glide Six, made by the Bartholemew Company, Peoria, Ill., sells for \$1095. It has exceptionally long gear shift levers to make driving as easy as possible and the quality of its parts is shown by the fact that it is the only car selling for less than \$1200 which incorporates the Brown-Lipe gearset.

Marion-Handley a New Model.

The Marion-Handley is a new product of the Mutual Motors Company of Jackson, Mich. It is a six-cylinder model and sells for \$1185 as a seven-passenger touring car or four-passenger roadster. It has a Reutenber motor, Brown-Lipe transmission, Salisbury axles and Westinghouse electric lighting and starting system.

The Detroit "Six-45," built by the Detroit Motor Car Company, is priced at \$1198 and is a car of moderate size and excellent appearance. It uses a wire cable brake control instead of rods.

The Elgin Six was shown in a Cloverleaf roadster design, which was not dissimilar from those produced by many manufacturers and is as neat and attractive in its general appearance as any. In it some of the awkward lines noticeable in a few bodies of the type have been successfully eliminated. The car has 114-inch wheelbase and sells for \$845.

The Elkhart Carriage and Harness Company, Elkhart, Ind., has produced an especially attractive little four-passenger roadster of the Cloverleaf pattern. Its price is \$795. It is equipped with a four-cylinder engine and has no unusual features of design. The wheelbase is 114 inches. The car weighs 2200 pounds and is driven by an engine which is 3½ by five inches.

New Halladay Six.

A new Halladay model, produced by the Barley Manufacturing Company, Streator, Ill., is priced at \$1085. It has wheelbase of 118 inches and a 38-horsepower Reutenber engine. Both this model and the larger car produced by the same company are sixes.

One of the 11th hour arrivals was the new Roamer, which is built by the Barley company for the Thomas, Evarts Adams Company, the New York City importers of the Lancia car. This company will handle the car in New York and

Boston and for all foreign trade, while the Barley company will put it out under the name of the Halladay Special in territory outside those bounds.

The car is designed along the lines of the British Rolls-Royce and is priced at \$1800. Aside from its distinctive body lines, the car is composed of standard parts, such as Reutenber motor, Grant-Lees gearset, Bosch magneto ignition, Stromberg carburetor and Lavigne steering gear.

The Cummins Monitor Company, Columbus, O., showed the car which it sells for \$895. It has a 3¼ by five-inch engine, 115-inch wheelbase and weighs about 2400 pounds.

The Farmack Four, made in Chicago, is equipped with a Farmer overhead valve engine in which the valves are operated by the camshaft direct without rocker arms or levers of any sort. The car is not unusual in other details and sells for \$855 in the roadster and touring types. The cabriolet is priced at \$1150.

BOSTON SHOW WILL BREAK RECORDS.

Chester I. Campbell, manager of the Boston automobile show, announced one month before the opening day, March 4, that he had already arranged for exhibits that exceeded in number those at any show held in any other city this year. At that time 107 different makes of pleasure cars and commercial vehicles had secured reservations, while a score or more makers were clamoring for space.

Seventy-four of the 107 makes were pleasure cars. There were 33 different makes of commercial vehicles. In addition to these exhibitors are the 175 individual accessory makers and distributors who had been awarded space in the balconies and basement.

This year eight pleasure cars will be shown in the balconies, there not being room for them on the main floors. The demand for reservations has been so great that the management has been forced to economize on space in every way. Notwithstanding, there will be shown six cars that are new to New England trade, the Bell, Hollier, Owen Magnetic, S. J. R., Fostoria and Daniels.

Much emphasis has been put upon commercial vehicle displays, inasmuch as the Boston show is the only one of the season in a large city where they are shown. They will range from light delivery units to huge five-ton trucks. Several manufacturers will show different types of fire apparatus and power vehicles used by municipalities.

ROCHESTER SHOW BIG SUCCESS.

One of the largest, most complete and most successful automobile shows ever held in Rochester, N. Y., was staged at Exposition park from Jan. 17 to 22 under the control of the Rochester Automobile Dealers' Association.

It was opened by the mayor of Rochester and the secretary of New York state, both of whom delivered addresses on the importance of the motor car and the large place which Rochester holds in the motoring world of the Empire state.

An elaborate musical programme was arranged for every afternoon and evening of the show and was given by the park band. There were over a hundred exhibits in place and there was sufficient floor room to display the cars and accessories to the best advantage.

The health of the motor car business in Rochester is demonstrated by the large programme published for the show and the amount of automobile and accessory advertising displayed in it. This handsome book carried reprints of the New York motor vehicle law and of the Rochester traffic ordinances, to make it of permanent value to the motorists who received it.

The officers and directors of the association who made the show successful are: President, C. E. Sager; vice president, A. R. McKenney; secretary, Paul Le Hardy; treasurer, E. M. Alling. The board of directors includes the officers and H. G. Strong, F. W. Beck and F. R. Leucher. Much credit for the success is due to C. A. Simmons, the manager of the show.

FALL RIVER SHOW WELL ATTENDED.

When the third automobile exhibition at Fall River, Mass., opened in the local armory Jan. 31, there were more than 50 cars on exhibition, which is an exceedingly large number for that city. Every foot of space was occupied and the management was kept very busy in handling the large crowds.

On closing day it was announced that despite the bad weather that generally prevailed during the week, sales and attendance broke all existing records for Fall River. One feature that attract-

ed the visitors, aside from the new 1916 models of automobiles, was the naval exhibit, which included a wooden model of the old U. S. frigate Vermont and the new first class battleship of the same name. These exhibits, together with the torpedoes, a four-inch gun, shells and projectiles of every description, were loaned for the occasion by the government.

MONTREAL'S AUTOMOBILE SHOW.

The attendance at the Montreal show held Jan. 22-29, was greater this year, despite the war conditions obtaining in Canada, than in any previous year. On opening day 5000 people attended from all parts of the dominion, while on the fifth day, military day, there were about 8000.



Exposition Park, Where Rochester Automobile Show Was Held.

The ticket takers were soldiers who had been wounded in the European war.

BUFFALO SHOW A BIG SUCCESS.

Exhibitors and the managers of Buffalo's 14th annual show were unanimous in the opinion that it was the most successful ever held in that city. It was opened Jan. 24 by Francis M. Hugo, secretary of New York state.

The decorations originally planned were to suggest the days when Nero reigned in Rome, but through failure of the decorator to supply the settings the scheme was changed to a picturesque view of Venetian life. A feature of the show was the number of second-hand cars that were turned in for new models, and the hundreds of prospects secured, which presage a big spring business for the local dealers.

WORCESTER HAS BIG SHOW.

When the Worcester automobile show, being conducted by the New England Amusement Company with the sanction of the Worcester Automobile Dealers' Association, opened Feb. 7, Manager Percival S. Clark was quoted as saying that the value of the exhibits reached a total of about \$100,000. The exhibits included practically every make handled in Worcester and two models that came from neighboring Massachusetts towns.

The Casino was handsomely decorated and judging from the crowd that appeared on opening night it was expected that fully 15,000 people would attend during the week.

GREENFIELD'S SHOW.

In organizing the Greenfield (Mass.) automobile show, fashion and industrial exposition, which began Feb. 7 and was to continue for a week in the Greenfield armory, the management drew upon Springfield, Brattleboro, Northampton and Boston for exhibits in the automobile section. It was the city's first exhibition of automobiles, and it was expected that the armory, which has capacity for 2000 persons, would be thronged all during the week. Every inch of space available for exhibits had been contracted for long in advance of the opening day.

PORTLAND PLANS NEARLY COMPLETE.

The Portland (Me.) Automobile Dealers' Association has nearly completed its plans for the annual automobile exposition to be held Feb. 21-27 in the new Exposition building. The structure contains 48,000 square feet of space and it was predicted two weeks before the opening that about \$250,000 worth of pleasure cars and commercial vehicles would be shown. Pleasure cars are to be displayed on the main floor, while accessories, trucks and motorcycles are to be displayed in the basement.

The decorative scheme for the first floor will be green and white and there will be thousands of roses and southern smilax arranged about the hall. The management has arranged for special railroad rates throughout the state during the week of the show.

PARADE PRECEDES HARTFORD SHOW.

The Hartford Automobile Dealers' Association has groomed the Broad street armory for

its show of automobiles. The scheme of decorations settled upon constitutes a tropical sunrise, suggesting by electric lights and draperies the rays of light at the beginning of day.

A feature of the Hartford show is that, providing the weather is propitious, it will be preceded by a huge parade of decorated automobiles through the streets of the city. The show proper will be opened by the mayor of Hartford.

Pleasure cars, commercial vehicles and numerous accessories will be on exhibition. Manager Ben F. Smith and his two committee associates, Russell P. Taber and John D. Evans, are confident that this year's show will exceed in interest and actual business done any that has been held in that city.

SCRANTON BREAKS RECORDS.

The management and exhibitors of the Scranton (Penn.) automobile show, which was held during the week ending Jan. 30, announced that during the first four days of the exhibition more people had attended than during the entire week of the preceding year, and that the sales actually made or contracted for future delivery were far in excess of those of 1914.

EXHIBITORS PLENTIFUL AT NEWARK.

Fifty-nine applications for space in the First Regiment armory for the eighth annual Newark (N. J.) automobile show, to be held Feb. 19-25, have already been received by Manager C. Louis Fitzgerald. Of these 36 are for pleasure cars and motor trucks, and the remainder are for accessories.

AUTOMOBILE ENGINEERS MEET.

F. E. Moskovics, chairman of the Indiana section of the Society Automobile Engineers, and commercial manager of the Nordyke & Marmon Company, announces that the next regular winter meeting of the section will be held Feb. 25 in Indianapolis. F. A. Cornell will present a very important paper, entitled "Anticipating Complaints," which will go into the problem of scientifically caring for service department complaints made by owners.

It was announced at the close of the Wilmington (Del.) automobile show, Jan. 25, that more than 100 cars were sold, and that between 40,000 and 50,000 people viewed the exhibits.

NOW THE LEWIS AND CLARK AUTO HIGHWAY.

THE Omaha Commercial and the Omaha Automobile clubs are planning an entirely new transcontinental highway, which will not compete with any of the other national routes, but will cross them all. It is to be known as the Lewis and Clark Highway and is to run from Seattle, Wash., to Savannah, Ga., a distance of 3522 miles.

There is said to be great dissatisfaction among the cities along the existing national roads because they have not been included in the itinerary. The present undertaking in providing a highway that will lend itself to convenient diagonal travel toward the northwest or southeast, will also enable many of these cities to be represented on a transcontinental trail.

The convention which is to formally organize the road association is to be held in Omaha this month. It is not the plan to build new roads, because many of those over which the route will go are already in excellent condition and with a small amount of attention to short connecting stretches will be capable very soon of comfortable travel.

From Savannah the road as planned will go to Atlanta, Birmingham, Decatur, Memphis, St. Louis, Kansas City, Omaha, Sioux City, Sioux Falls, Cody, Wyo., Billings, Missoula, Spokane, and from there follow the route that has already been designated as a part of the National Parks Highway or of the Yellowstone Trail to Seattle.

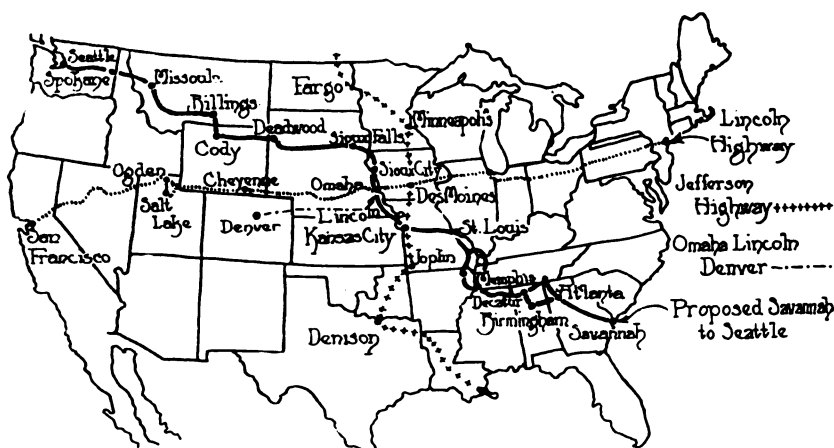
STUDEBAKER TELEPHONE PLAN.

At two or three mile intervals on the main roads of western New York state steel boxes are being placed on the telephone poles which contain coin box telephones. The boxes have signs over them bearing the words "Studebaker Service." These telephones have been contracted for at a flat rate of \$13 each and each Studebaker dealer in the territory obligates himself to put up at least 10 of them. Keys to the boxes are rented to motorists for 50 cents each and they then can use the telephones anywhere in the dis-

trict for any purpose. There is no charge for a call within five miles of the box, but for longer distances the regular tolls are charged for, collections being made through the coin box.

CARS STOLEN IN CHICAGO.

In 1915 more than 2000 insured motor cars were stolen in the city of Chicago and of these 1763 were recovered chiefly through the efforts of an organization of the 40 insurance writers who operate in the city. Fred J. Sauter is head of the organization, which issues a bulletin at short intervals describing the cars that have been stolen since the last issue and offering a reward for their recovery. Of the 422 machines not re-



Proposed New Lewis and Clark Highway, Stretching Diagonally Across the Continent from Seattle to Savannah.

covered 298 were Fords. More of this make is stolen than any other because of the great number in use. They are easier to disguise and harder to find than others.

There is a movement on among insurance writers to get the manufacturers to adopt some sort of locking device, preferably a gasoline lock, as standard equipment. The many thefts have caused insurance rates to be doubled in many places.

BURRAGE JOINS SNOW STAFF.

Walter B. Snow and Staff, Boston, Mass., announce the addition to their organization of Charles W. Burrage, formerly an instructor at the Massachusetts Institute of Technology and one of the compilers of Sweet's Index. They are advertising agents and publicity engineers.

R. S. DRAKE IS DEAD.

Roy Stannard Drake, editor of Automobile Topics, a trade paper devoted to motor vehicle interests, died Jan. 30 at his home in New York City. He was born in Cleveland, O., and was in his 36th year. His first business activities were in the newspaper field, with the Cleveland Plain Dealer and later with the Press. For the latter paper he acted as Washington correspondent, reporting the activities of the United States Senate.

His connection with the automobile industry began with his association with the advertising department of the Winton Motor Car Company, Cleveland, which was followed by association with Post & Lester, Hartford, Conn., as advertising manager.

Mr. Drake's automobile editorial career began with Motor World. He became editor of Bicycling World, which was affiliated with Motor World editorially at that time. When F. W. Roche bought Automobile Topics Mr. Drake became its editor. He is survived by his mother and aunt.

OHIO MOTORISTS TO ASSEMBLE.

Owners of automobiles in Ohio will gather in Akron, March 31 and April 1, for the annual convention of the Ohio State Automobile Association. Among the matters to be considered is a new movement for a general lighting law. Also such problems as affect motorists and the general public will be thoroughly discussed, and in addition a legislative programme is to be outlined to the visitors. The visiting delegates will be entertained by the Akron Automobile Club. A number of events of unusual interest are being arranged. The gathering promises to be the largest and most representative of its kind ever held in Ohio.

URGES TRADE ASSOCIATIONS.

Speaking before the Rubber club of America on Feb. 2, Edward N. Hurley, vice chairman of the Federal Trade commission, gave his unequivocal approval to the formation of co-operative trade organizations to improve conditions in special businesses. He indicated that such organizations were not considered as subjects of attack for the government business regulators.

Most of his address was devoted to urging the development of proper cost accounting sys-

tems. He said the commission had discovered thousands of firms whose cost systems were inadequate and who set prices on goods arbitrarily without knowing what they cost.

This he said often resulted in forcing the market below the cost of production and brought widespread disaster not only to the firm that had the faulty cost system, but to all others in the same line. Many firms were discovered that were not writing off depreciation or were making their reserves for that item hopelessly too small.

The introduction of proper cost systems will be one of the leading items in the constructive work of the commission. He pointed out that it was now possible for business men to apply to the commission and find out just what they could and could not do in competition, in place of the former uncertainty on that point.

PREMIER TO BUILD RACERS.

Two racing cars are to be built by the Premier Motor Corporation of Indianapolis on order from the Indianapolis speedway management, which will enter them in its own and other races. The track owners already have four Maxwells and two Peugeots, so they will be able to place a large number of drivers on the track. The Premier company will also turn out spare parts for the Peugeots, which will be driven by Howdy Wilcox and Johnny Aitken. These cars were driven in the Astor race, and it has been found that replacements are necessary. The parts cannot be secured from Europe.

CANADIAN REGISTRATIONS 83,128.

In spite of the war 22,070 cars were added to those in operation in Canada, according to the registration figures just given out which show that 83,128 cars are owned in the dominion. The increase for the year was 62 per cent. The cars are distributed as follows:

Provinces	1914	1915
Alberta	4,268	5,192
British Columbia	6,378	5,192
Manitoba	7,148	7,811
New Brunswick	1,269	1,941
Nova Scotia	1,701	2,435
Ontario	25,020	36,300
Quebec	6,850	8,383
Saskatchewan	8,415	11,966
Total.....	61,058	83,128

GENERAL NEWS OF THE INDUSTRY.

Splitdorf Annual Statement Shows Remarkable Profits in Parts Field—Goodrich Reports Big Earnings, and Several Car Makers Indicate Prosperity.

THE financial report for 1915 of the Splitdorf Electrical Company, Newark, N. J., gives evidence of the great prosperity of the parts makers. This company probably leads the others in its field, particularly in point of huge earnings and profits, as is shown by the statement.

The net profits for 1915 are nearly double those of 1914, the total on Dec. 31, 1915, being \$1,134,029. The assets totaled \$6,451,362, of which \$24,561 was cash in hand and in banks, and \$1,157,271 in the form of investments. Notes and accounts receivable totaled \$745,947, and loans \$589,125.

That the company has large surplus, without considering the large value of the other quick assets, is shown in that the total liabilities outside of the capital stock of \$4,393,000 are only \$924,333. This surplus is far in excess of any probable cash requirements.

The main items of the balance sheet as of Dec. 31, 1915, are as follows:

ASSETS.	
Cash in banks and on hand.....	\$24,561.03
Advances to salesmen and sundries.....	3,345.87
Notes receivable	85,189.67
Accounts receivable	660,757.43
Loans	589,125.95
Insurance unexpired	12,813.23
	<hr/>
Real estate and buildings, plant No. 1.....	\$1,375,793.18
Real estate and buildings, plant No. 2.....	\$230,385.50
	<hr/>
	\$330,385.50
Machinery and equipment.....	\$312,669.29
Furniture and fixtures	9,606.00
Benches	4,872.26
Autos, trucks and motorcycles.....	11,100.00
Merchandise (Inventory Dec. 31, 1915).....	1,249,665.36
	<hr/>
	\$1,587,922.91
Patents and good will.....	\$2,000,000.00
Investments	1,157,271.00
	<hr/>
	\$3,157,922.91
Total.....	<hr/>
	\$6,451,362.59
LIABILITIES.	
Capital stock	\$4,398,000.00
Less treasury stock.....	5,000.00
	<hr/>
	\$4,393,000.00
Accounts payable	\$255,132.86
Notes payable	625,000.00
Reserve for customers' discount.....	9,911.36
Reserve for 1915 taxes.....	7,500.00
Personal taxes retained.....	357.48
Royalties accrued	26,431.50
	<hr/>
	\$5,317,333.20
Net profit to Dec. 31, 1915.....	\$1,134,029.39
Net profit to Dec. 31, 1914.....	388,921.84
	<hr/>
Net profit year 1915.....	\$745,107.55

In this statement is included only the profits made by the Splitdorf Electrical Company proper and \$52,500 in dividends received from the company's subsidiaries,

which report earnings of \$131,597.97, beside the dividends paid and excluding the operations of the Sumter Works, Sumter, S. C., belonging to the Apple Electric Company.

GOODRICH PROFITS \$12,200,000.

A preliminary statement of the B. F. Goodrich Company, Akron, O., shows for 1915 estimated profits of \$12,200,000 as compared with \$5,440,000 in the previous year and a balance for the common stock of \$10,200,000, as compared with \$3,370,000 in 1914.

This was equal to 17 per cent on the \$60,000,000 common stock and the directors have placed the stock on a four per cent. per annum basis by the declaration of a quarterly dividend of one per cent. payable Feb. 15. Out of the surplus earnings for the year the company has set aside \$1,000,000 for preferred stock redemption and \$1,700,000 for various reserves.

The preliminary statement of the company as issued for the year ended Dec. 31 compares as follows:

	1915	1914	Increase
Net profits	\$12,200,000	5,440,427	6,759,573
Preferred dividends	2,000,000	2,068,500	*68,500
Balance	10,200,000	3,371,927	6,828,073
Per cent. on common stock	17.00	5.62	11.38
Preferred stock redemption	1,100,000	900,000	200,000
Various reserves	1,700,000	.....	1,700,000
Previous surplus.....	3,100,000	705,982	2,394,018
Total surplus	10,500,000	3,177,910	7,322,090

*Decrease. †Partly estimated.

The company's financial position has improved during the year as the amount of quick assets over the current liabilities shows a gain of approximately \$8,100,000. Current assets are approximately \$31,250,000, and current liabilities \$4,200,000, leaving a working capital of about \$27,000,000, or about the par value of preferred stock outstanding.

The directors voted to retire 7000 shares of the preferred stock prior to July 1, 1916. This makes a total retirement of 27,000 shares, covering the charter provisions.

The official statement called attention to the fact that while the results of the year's business were highly satisfactory, the contributing causes may not be permanent. One of these causes was the large increase in volume of sales as compared with 1914, with the result that overhead expenses consumed a smaller percentage of the gross earnings than could be reasonably expected under normal conditions. The statement also referred to the company's fortunate purchase of raw materials before the supply became restricted.

As regards war business Goodrich has had its share, but it is explained that the total amount exported probably has not exceeded five per cent. of the total gross business.

STUDEBAKER CALLS NOTES.

The Studebaker Corporation has called for payment March 1 the remaining \$2,308,500 of its five per cent. serial notes. This wipes out the last of the \$8,000,000 note issued sold March, 1912. It is understood that cash assets of the corporation are about \$5,000,000, and that current shipments of Studebaker cars are the largest for this period in the company's history.

RECEIVER FOR GREAT WESTERN.

It has been announced that Claude Andrews of Peru, Ind., has been appointed receiver for the Great Western Automobile Company of the same city by the federal court on a petition from three creditors who claim the company, owing \$80,000, was insolvent. Andrews was authorized to continue the business and fill orders received.

THREE DRIGGS-SEABURY DIVIDENDS.

The directors of the Driggs-Seabury Ordnance Company have declared dividends, payable March 15, to stock of record March 1, of 3½ per cent. and three per cent. respectively on the first and second preferred stocks for the period from Sept. 1, 1915, to March 1, 1916. On the common stock dividends have been declared at the rate of 2½ per cent. quarterly.

CHALMERS OFFERS STOCK.

The Chalmers Motor Company, Detroit, has offered to shareholders the right to subscribe at par to \$500,000 new seven per cent. cumulative preferred stock. The company had \$2,000,000 preferred stock authorized and \$1,500,000 was issued, of which somewhat more than \$300,000 had been retired by sinking fund. The offering is understood to have been underwritten.

GRANT MOTOR MARKETING STOCK.

The Grant Motor Car Company's \$1,000,000 seven per cent. cumulative preferred stock is now being offered for subscription, when, as and if issued, at \$105 a share, with a bonus of 20 per cent. in common stock. The amount of common outstanding is \$2,000,000, one-half of which is reserved for conversion of the preferred stock. The preferred is convertible into an equal amount of common stock (at the ratio of 10 common for one preferred) at the option of the holder at any time prior to Jan. 1, 1919. This preferred has par of \$100 and the common \$10 per share.

The combined earnings of the company, which represents the present corporation for the year 1915, were about \$165,000. President D. A. Shaw estimates from sales for 1916 that net earnings will approximately be \$720,000. He is figuring on an annual production of 12,000 cars this year, and beginning about July 1 this schedule will be increased to 15,000 cars.

INTERNATIONAL MOTOR'S BIG YEAR.

The year 1915 was one of the most successful in the history of the International Motor Company, due to both

war and domestic business. Domestic sales in December made a new high record and for the full year home business increased 20 per cent. over 1914.

Net profits for the year amounted approximately to \$750,000, which is equivalent to slightly over 20 per cent. on the preferred stock.

CHEVROLET-GENERAL MOTORS.

The Chevrolet-General Motor syndicate announces that the offer of exchange on the basis of five shares of Chevrolet for one share of General Motors common was closed on Jan. 25. Hereafter offerings will be considered at not to exceed four of Chevrolet for one share of General Motors. The syndicate represents interests closely identified with W. C. Durant.

The additional Chevrolet shares which will be issued will pass into the strong interests which at present control General Motors, and little is likely to find its way to the market.

General Motors common is earning about \$140 a share, and Chevrolet at the rate of about \$25, so that the equity which the new Chevrolet will represent in General Motors profits will be somewhat larger per share than the present rate of profits on Chevrolet stock as a \$20,000,000 company.

C. S. BRIGGS TO BUILD MOTORS.

Claude S. Briggs, who has been prominent in automobile affairs for several years, is organizing a company to manufacture an eight-cylinder motor. Definite details are expected early in February. The factory will be located in Detroit. Contracts have been let already for a large building to be erected at Junction avenue and the New York Central railroad.

Tests of the new motor have been under way for several months, it is reported, and the company is planning to begin deliveries in April. With Mr. Briggs are several men who are well known in the industry.

94,437 OVERLANDS BUILT IN 1915.

Final figures for the production of Overland cars for 1915 show that 94,437 cars were turned out during the year. This is at an average rate of 315 per day for 300 days. The plant is now shipping in the neighborhood of 700 cars a day, the maximum for 24 hours having so far been 722. During the year previous 48,468 cars were shipped, or at a rate of 161 per day. The production, therefore, has been practically doubled.

DUNLAP IS CHANDLER SALES MANAGER.

James M. Dunlap, well known in national advertising circles for the past 10 years, assumed the duties of sales manager for the Chandler Motor Car Company, Cleveland, on Feb. 1. For the past two years he directed and wrote the national advertising for the company, and during 1915 was in very close touch with the work of the sales department, which was then in charge of C. A. Emise, first vice president. Mr. Dunlap has resigned from the Dunlap-Ward advertising agency of Chicago and Detroit, which he founded five years ago.

CHALMERS NEW SALES MANAGER.

Frank B. Willis has been appointed sales manager of the Chalmers Motor Car Company by Paul Smith, vice president in charge of sales. He has been in the organization for a year and a half and was district manager in the eastern territory until he was made assistant sales manager some time ago.

REGULAR STUDEBAKER DIVIDENDS.

The Studebaker Corporation has declared its regular quarterly dividend of $1\frac{1}{4}$ per cent., with the usual one per cent. extra on common stock, and the regular quarterly dividend of $1\frac{1}{4}$ per cent. on the preferred. Both are payable March 1 to stock of record Feb. 19.

FORD TRACTOR COMPANY.

The Ford Motor Company announced that at a meeting of its stockholders the company assigned and quit-claimed to Henry Ford, personally, all interests and rights in the farm tractor business. It is expected that he and his son Edsel B. will conduct the manufacturing and marketing as a separate enterprise under the firm name of Henry Ford & Son.

FRANKLIN ELECTS OFFICERS.

The following officers were elected at the annual meeting of the Franklin Automobile Company, Syracuse, N. Y.: H. H. Franklin, president; Arthur Holmes, vice president; Frank A. Barton, secretary and treasurer. The directorate includes the officers and John Wilkinson and E. H. Bann.

CHANGES IN BEARINGS COMPANY.

The Bearings Company of America, New York City, announced the following recent changes in its organization: John W. Hertzler, who for several years has been the western representative, with headquarters at 604 Ford building, Detroit, has been appointed assistant manager. He is succeeded there by William C. Little, who has represented the Buda and Brandenburg companies in that territory in the immediate past.

NEW MAXWELL RULE.

The Maxwell Motor Company has announced that the dividend of $1\frac{1}{4}$ per cent. declared on the first preferred stock will be paid by the voting trustees on April 1 only to holders of first preferred stock certificates of record March 10. Holders of warrants who desire to receive the dividend are required to exchange them for stock trust certificates on or before that date.

FORD TO TRIPLE OUTPUT.

Vice President Klingensmith of the Ford Motor Company has announced that about the last of February the company will begin erection of additional building that will enable the company to triple its present output. The improvements mean an expenditure of between \$5,000,000 and \$10,000,000. According to Mr. Klingensmith the company is to employ 100,000 men within five years. The number at present is about 25,000 at Detroit and 10,000 more in the 50 branches and serv-

ice stations. The aim of the company is to produce 500,000 cars this year.

TO MAKE SAGINAW EIGHT.

The Lehr Motor Company has been organized with \$500,000 capital stock at Lansing, Mich., and will produce the Saginaw Eight at \$1050. The company will manufacture the minor parts in a factory there, but will buy the larger units from standard producers. The officers of the company are, W. M. Guider, president; A. F. Myer, vice president; C. M. Schwahn, secretary and treasurer.

RUTHERFORD IS PROMOTED.

W. O. Rutherford has succeeded to the office of general sales manager of the B. F. Goodrich Company, Akron, O., following the re-

linquishing of that position and title by H. E. Raymond, second vice president, to whom Mr. Rutherford was assistant. Mr. Raymond will continue as vice president, having general supervision over sales and advertising policies.

Mr. Rutherford has been connected with the company for 17 years, has been branch manager at Denver, Detroit and Buffalo, going from the latter office to headquarters as Mr. Raymond's assistant about 10 years ago.



W. O. Rutherford, Sales Manager of Goodrich Company.

OWEN HEADS NEW COMPANY.

Percy Owen, formerly sales manager of the Chalmers Motor Car Company, and more recently vice president in charge of sales of the Saxon Motor Car Company, is president and general manager of the Liberty Motor Car Company, which has secured the plant of the R. C. H. Corporation in Detroit. James F. Bourquin, recently production man for the Paige Detroit Motor Car Company, is vice president. He was at one time superintendent of manufacturing for the Chalmers company. R. E. Cole, who was engineer of the Saxon company, and H. M. Wirth, former Saxon purchasing agent, are also members of the organization.

SHOW MANAGERS REPORT HEAVY BUYING.

A volume of sales at the automobile shows that exceeds anything that has been previously known is reported by the Studebaker Corporation, which takes the fact as an indication of an overwhelming volume of business to come. There is much more eager buying by dealers at this season than previously. This is because having been unable to get enough cars last year they anticipate another shortage and wish to lay in a large stock. Some of them are investing enough of their own money to enable them to take care of a 100 per cent. increase in business for the season.

The Studebaker Corporation is planning an output of 100,000 cars for the year and is producing at full force in sufficient volume to reach that output. The great demand developed by the New York and Philadelphia shows is being continued in the middle west. As showing the heavy buying by dealers the Studebaker Corporation says that it has received orders for train load deliveries to Chicago, Milwaukee, Madison, Lacrosse, Minneapolis, Sioux Falls, Grand Forks, Fargo, Des Moines, St. Louis and several other cities.

GRANT CONQUERS ROUGH TRAILS.

A Grant Six was recently subjected to a carburetor and efficiency test over some exceedingly rough mountain trails in California and established an altitude and endurance record. The itinerary included visits to Camp Baldy and the summit of Mt. Wilson by way of Bear Valley over the Santa Ana canyon and Clark grade route. The entire trip covered a distance of 248 miles and the total altitude climbed was 18,616 feet. This distance was made in one day.

The car was a stock model and one that had received severe usage before the trip, including three trips to San Francisco from Los Angeles.

PACIFIC TREADS ARE GUARANTEED.

Pacific Steel Studded Treads, made by the V. K. Sturges Company, Oakland, Cal., which can be fitted to old but sound tires of either smooth or non-skid type, are guaranteed for 5000 miles both as to wear and immunity from punctures.

The main body of the tread is made of a special fiber, the nature of which is not made public and in this are embedded studs of the hardest steel. The special fiber is said to be tougher than leather, it has no laps or joints, will not stretch

and is very flexible and water proof.

The tread is fitted over the outside of the tire and is cemented on. Tires selected for treatment should be perfectly sound and smooth inside, although the exterior rubber may be cut and scarred. The work of fastening the treads upon the tires may be done by the factory or the J. B. Gross Corporation, 162 West 34th street, New York City, which is the eastern representative. Directions are also supplied to others.

The use of similar steel treads is very general in Europe and in some countries has even been required by regulation. The guarantee of the company is backed up by numerous letters from users who have secured remarkable results from the treads.

THE AUTOMOBILE BOOK.

One of the best of the recent books relating to automobiles has been written by Charles E. Duryea, the pioneer automobile designer—the man who made and sold the first motor car in America, and James Homans. It covers the subjects of construction, operation and care in a clear, understandable and authoritative way. It deals with many phases of the subject that are not touched upon by other books. Some of the chapter headings are "Anticipations of the Motor Car," "Selecting a Motor Car," "The Gas Engine," "The Cycles of Gas Engines," "Gas Engine Elements."

The title of the volume is the Automobile Book, and it is published by Sturgis & Walton Company, New York City.

CANADIAN GASOLINE SUBSTITUTE.

The use of alcohol as a substitute for gasoline in the event that the prices continue to rise was discussed recently at a meeting of the Winnipeg Automobile Trades Association. Experiments about four years ago showed that alcohol could be used as a substitute for gasoline with very slight carburetor adjustments, but the matter was dropped because the price of gasoline was such that at that time that alcohol was more expensive. If the present price tendency for gasoline continues this situation may change, however, and the proposition may again be taken up. Frosted or smutty grain can be used to produce alcohol and this would enable western Canadian farmers to dispose of their damaged product.

MOTOR STARTING AND CAR LIGHTING.

Westinghouse Generators Designed for Supplying and Distributing Current for Ignition Systems, and the Different Devices Used in Their Operation.

WESTINGHOUSE generators and motors of the latest designs have been described in these articles, and these systems are the two-unit type, the generators being usually driven by coupling directly to an outside shaft actuated by a gear from the timing gearset, and the motors by a pinon on the armature shaft that meshes with an external ring gear either cut into or shrunk on to the periphery of the flywheel. With this system of motor coupling there are none of the complications to be found with other forms of drive, such as chains, friction pulleys or auxiliary gears, and claim is made that this is the most simplified construction.

There is, of course, two different machines in such systems, but the generator is driven all the time that the engine is running, while the motor is only used to start the engine, so that the wear that might be expected in a single machine, such as a motor-generator, is not manifested in either unit.

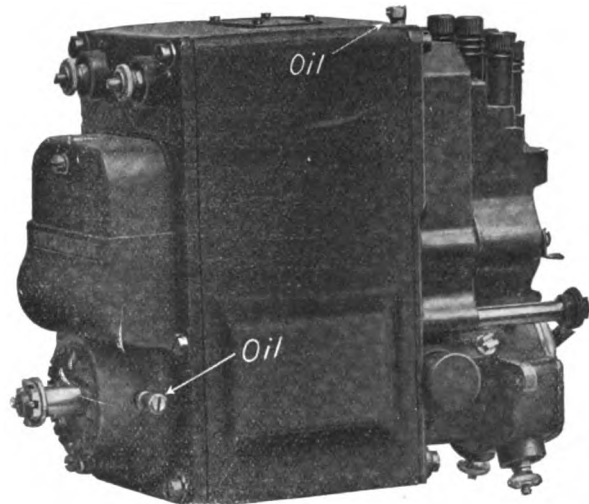
As has been stated, the use of either starting or lighting equipment entails the installation of a battery, and with a battery as a source from which there ought to be a dependable flow of current at all times there is very general utilization of the timer or distributor means of governing the ignition of the engine. The magneto can be regarded as thoroughly reliable for production of ignition current, but many vehicle designers believe that when the current must be used for lighting and starting there is no real need of installing a magneto, especially when the generator can be combined with an igniter, which will draw but comparatively little current and will not necessitate a larger or heavier unit.

Three Forms of Igniters.

When a type of igniter other than a magneto is desired, this may be in one of three forms, built into and incorporated with the generator, a separate unit mounted on the generator, or an entirely separate unit. In no instance will the use of the igniter be a drain upon the battery or in any way affect its efficiency for lighting the vehicle or starting the engine. As a matter of fact a remarkably small flow of current is needed. Any ignition current must have high voltage to insure

that it will arc at the air gap in the spark plugs, and the voltage may be as high as 20,000, but the amperage will be so slight that its flow can only be measured with a very delicate instrument.

So far as the battery is concerned, this need not be heavier or larger when used as a source of ignition current than if utilized for lighting and starting, or merely for lighting. In fact, many car designers have combined either a dry cell or a storage battery with a magneto to insure against any possible failure of current supply in the ignition systems, and the exchange of a small storage battery for one of larger size will add but little to the weight. The difference is so slight



Westinghouse Lighting and Ignition Generator with Self-Contained Interrupter, Distributor and Coil.

that it need not be regarded for all practical purposes.

The Use of Circuit Breakers.

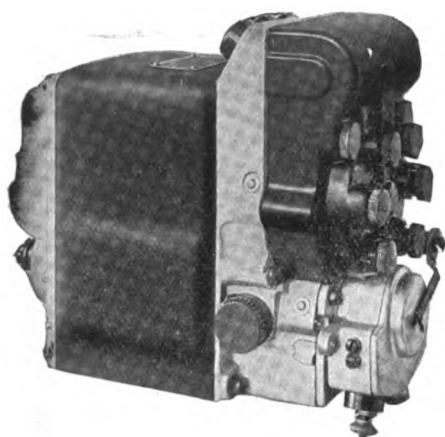
For the information of those not thoroughly informed relative to ignition systems, statement may be made that in any system in common use the current must be opened and closed to obtain arcing at the spark plug gaps in the cylinders, and this is done by a circuit breaker or interrupter. The current from the transformer coil passes through the contact points of the breaker, one of which is stationary and the other mounted on a pivoted lever. When the points are separated the

spark is created. Breakers are generally so designed that they may be rotated part way around the shaft, and when the breaker is rotated in the same direction that the shaft is turned the spark will occur later in the cylinder, and when the breaker is rotated in the opposite direction the spark will occur earlier in the cylinder, either retarding or advancing the spark.

When circuit breakers are used with batteries and single-unit coils they are generally combined with distributors, the coil and the switch being separate. The breaker may be so arranged that it will receive the primary current from the battery.

The Distribution of the Current.

The distributor is designed to take the high-tension or secondary current from the single unit transformer coil and by making a series of contacts in rotation send the current through the



Westinghouse Type 246 Lighting and Ignition Generator with Self-Contained Interrupter, Distributor and Coll.

spark plug circuits so that the sparks will occur at the precise time desired in the engine cylinders. The time that the spark will occur in the piston stroke is governed by the point at which the breaker breaks the current in the coil, or when the timer causes the current to flow, the distributor being merely the means of sending the current to the right cylinder. Distributors are used on all magnetos for engines with more than one cylinder, in combination with circuit breakers and single spark systems using a battery current without a magneto, and sometimes as a separate unit combined with an ordinary timer in connection with one vibrating coil. There is no need for discussion of the characteristics of distributors, the statement above being made with a view of familiarizing the reader with the usual purposes of circuit breakers and distributors.

Timers, however, are used only with battery ignition. The timer is an instrument that will send the primary current to the transformer coil at the desired instant, so that it may be transmitted to the cylinder that is to be fired. The timer

may be used without a distributor, in which event there will be as many separate coils as there are cylinders for the engine. When used with a distributor there will be but one coil, and there will be as many contacts or firing points as there are cylinders to be fired. Generally speaking, the distributor is always used with some form of breaker or interrupter.

Constant Voltage Ignition.

The Westinghouse system of ignition includes what is known as constant voltage ignition without vibrators or multiple unit coils, this being an exceedingly simplified construction that has been demonstrated by service and experience to be extremely enduring and dependable and highly efficient.

The current is provided from a generator, which may be either the rectangular or the round shape, and which will possess the general characteristics of those that have been described. That is, the generation of the current may be either regulated inherently, in which event the battery charging current passes through the series winding of a reverse compound field; by potential control, in which a vibrating contact controlled by the generator voltage intermittently short-circuits a high resistance in series with the shunt field and by a third brush. The third brush regulation insures a higher or lower rate of current at any given vehicle speed through the location of the brush, which is between the two main brushes and is connected to one end of the shunt field winding, and the other to a main brush.

The Manner of Regulation.

The manner of regulation used depends largely upon the requirements of the designer of the car. With these there is, of course, the reverse current relay or circuit breaker, which disconnects the battery from the generator when the voltage of the battery exceeds the voltage of the current generated, and there is the regulator control of the charging. The reverse current relay or circuit breaker is sometimes known as a magnetic switch.

Obviously the generator must be combined with some device to create and distribute the ignition current, and this may be in a rectangular frame with the interrupter and the distributor in a single unit, taking the current from the battery; or it may be a round frame with the interrupter and distributor unit mounted on it vertically, or it may be a generator with a separate unit for the interrupter mounted vertically on the engine.

Self-Contained with Generator.

When the generator has a rectangular frame the interrupter and the distributor are self-con-

tained with it. The interrupter is so constructed that the period of contact is practically the same at any speed, so that the voltage is neither increased nor decreased, and is uniformly maintained at all speeds. This automatic spark advance is extremely practical and with it there is no danger from neglecting to retard the spark before cranking the engine and the claim is made that the efficiency and power production of the engine are markedly increased.

The interrupter is constructed with two weights that are retained in position by a pair of springs and when the primary circuit is made the centrifugal weights push down a fiber bumper which causes the interrupter contacts to close. Then the weights move off the fiber bumper, causing the contacts to suddenly separate or open, which induces a high voltage in the secondary winding of the coil, and the spark is made in the cylinder to which it is directed by the distributor.

As the speed of the engine is increased the centrifugal weights are thrown out from the centre, automatically advancing the time of the closing or opening of the interrupter contacts, and producing the spark earlier. At the same time, due to their shape, the weights keep the contacts closed during the greater part of the revolution when driven at high speed, and this makes the period of contact practically the same at all speeds and prevents the spark voltage diminishing at fast speeds. The automatic advance has a range of movement of 45 degrees. Provision is made for connection to obtain manually operated advance, and the company recommends that this connection be made, but the spark control lever need not be touched after the original adjustments, the automatic controller taking care of, in a very efficient way, of the normal changes of operation.

The circuit is broken in the interrupter at high velocity. The sparking is reduced to the lowest possible minimum by the design of the transformer coil. The interrupter is mounted on the generator shaft, where it is readily accessible and the case can be removed without tools.

Distributor a Face Plate Type.

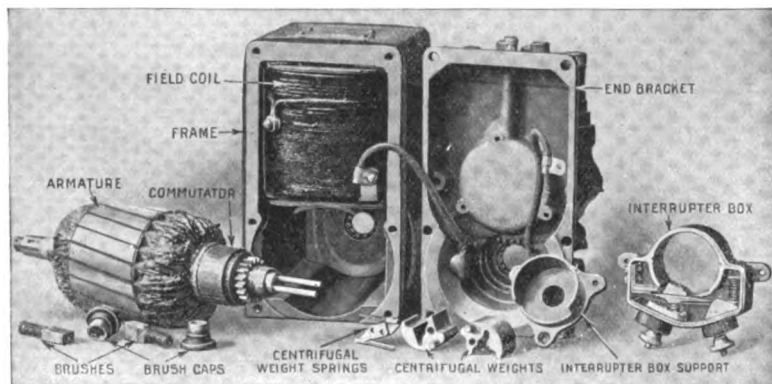
The distributor is a conventional face plate type, specially designed so that the detachable distributor plate can be easily placed in position without interfering with the contact brushes and without special tools. The body is made from a highly insulated heat resisting composition that

will not soften at high temperature. There are no additional air gaps in the high-tension circuit.

The transformer coil is small, compact and efficient, having a special design, and forms a part of the generator. The core of the coil is a special silicon steel to increase the efficiency, and the heat energy delivered to the spark is claimed to be several times that of the average coil. The proportions and windings of the coil have been carefully designed and the design of the coil and the condenser is such that sparking at the interrupter contacts is minimized and adjustment of the interrupter contacts is practically never necessary.

The Transformer Coil.

The transformer coil is made an integral part of the generator, with an ignition switch mounted on the dash. This construction is exceedingly compact and as there is no wiring between the generator and the coil the inductance is consider-



A Westinghouse Lighting and Ignition Generator Partly Disassembled, Showing the Interrupter Mechanism.

ably lessened. The coil is solidly imbedded in the insulating material of the distributor plate and all connections to it are made automatically by putting on the distributor plate and inserting the holding screws. The ignition switch is so constructed that the direction of the current through the interrupter contacts is reversed every time the switch is turned "on," which considerably reduces the wear on the interrupter contacts.

Should there be a desire for this construction a kick switch with lever and removable plug can be provided in the place of the switch that has been described. With a kick switch the direction of the current through the interrupter contacts depends on the position of the plug when it is inserted, and reversal of the current is frequent. A kick off switch with starting contacts is sometimes used with an electrically operated starting switch.

The vertical ignition unit, which may be mounted on the generator case and driven by the

generator shaft, or so placed that it may be driven by the engine, is part of a system that includes this unit, an ignition switch, a ballast resistor and a battery. These are made for use in six or 12-volt circuits and with four, six or 12-cylinder engines. There are certain differences of constructional detail, but the principles of operation are the same. The vertical ignition unit consists of four principal parts, these being the interrupter the condensor, the induction coil and the distributor, which are all included in one case.

One wire leads from the battery or generator to the ignition unit, and one other wire to each spark plug. The interrupter is placed in the low-volt end of the set, and it has the same type of circuit breaker as have the other ignition and lighting generators, but there is no provision made for automatic spark advance. It can be used equally efficiently for either direction of rotation without change. The interrupter is enclosed by a

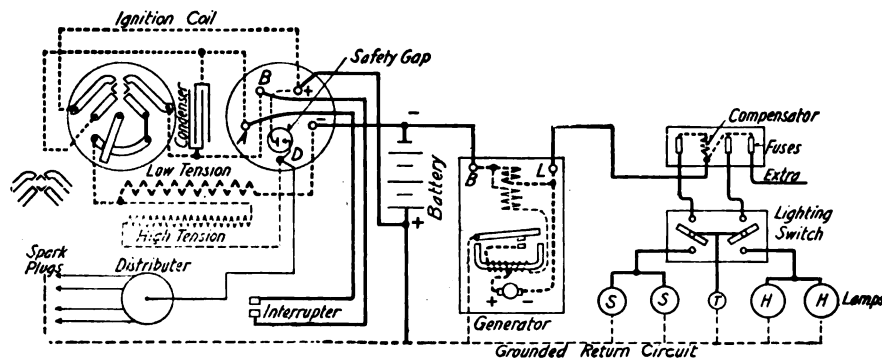


Diagram Showing the Connections of a Westinghouse Lighting and Ignition Generator System, with Two-Pole, Two-Gang Lighting Switch and Compensation Fuse Box.

spring collar which can be readily removed for inspection or adjustment of the contacts. The collar makes a tight joint and is clamped by a screw.

The spark coil is imbedded in heat proof insulating material and the condensor is well insulated. Both are contained in a tube of bakelized Micarta, which forms the body of the unit. The distributor is a very simple construction, with a wiping brush contact of the same type that is used on the ignition generator. It clamps to the upper end of the set. The entire ignition set is intended to mount vertically, connected by suitable gearing to the pump or magneto shaft. As a backward movement of the interrupter shaft is possible to approximately 48 degrees before giving motion to the circuit breaker cam, the interrupter cannot produce a spark to cause back firing in "rocking" the engine when cranking it by hand.

(To Be Continued.)

INVESTIGATE OIL PRICE LEVEL.

The Department of Justice and the Federal Trade Commission have both embarked on an investigation of the gasoline price level as a result of a recent report by the geological survey. The government experts reported that not only was more crude oil produced during the past year than in any recent year, but that this had come about in spite of a strong effort to limit production in order to keep up prices.

Export figures on gasoline show that shipments to the warring countries do not account for the high price, as less has been shipped abroad this year than in either of the last two years. It reported also that 220,000,000 barrels of crude are now held in reserve, which is an increase of 50,000,000 over the reserves of a year ago.

The 1915 production, according to the survey, was 267,400,000 barrels, which is 2000 barrels

more than last year. This is a direct contradiction of the reports of shortages circulated by oil producers. However, the report declares that consumption has increased enormously, although no exact figures on it are available and the price of crude has risen since August from \$1.35 to \$2.15. It may reach \$2.50, its previous high level. This increase has come about in spite of the large increase in reserves.

During the 10 months that ended in October last, 98,471,466 barrels of gasoline left the United States, against 140,275,273 barrels in 1914, and 100,353,871 in 1913. This is a marked decrease in exports.

The survey declares that the relation between the cost of gasoline and of crude petroleum is hard to discover because of the fact that so many other products besides gasoline are produced from the crude. The Rittman process, which is said to double the amount of gasoline refined from a given amount of crude, has now been taken up by several companies and it is expected that in a year the new process will have had time to affect considerably the price, or at any rate, the production.

The table given shows the output of petroleum for the various states and indicates the fact that there has not been a decrease, taking the year as a whole. It is admitted, however, that

there has been a decline in production in the Cushing fields in Oklahoma during the latter part of the year, which may be permanent.

To offset this decline new pools have been discovered in Texas and Louisiana. These are expected to produce largely in the future.

These are the figures of production in the various states :

State	1914	1915
California	93,775,327	89,000,000
Oklahoma	73,631,724	80,000,000
Texas	20,068,184	26,000,000
Illinois	21,919,749	18,500,000
Louisiana	14,309,435	18,500,000
West Virginia	9,680,033	9,000,000
Pennsylvania	8,170,335	8,700,000
Ohio	8,536,352	7,900,000
Wyoming	3,560,375	4,200,000
Kansas	3,103,585	3,000,000
Indiana	1,335,456	1,000,000
New York	938,974	900,000
Kentucky	502,441	450,000
Colorado	222,773	200,000
Other states	7,792	50,000
Total	265,762,535	267,400,000

The Western Petroleum Refiners' Association has sent out a circular pointing out that the impression that a tax of a certain amount per gallon on gasoline would not be paid by the refiners or the Standard Oil Company, but would be passed on to the consumer. It shows that through the use of gasoline, automobiles, farm machinery and lighting and cooking equipment, practically everybody would be affected by the tax.

TIRES LAST LONGER IN WINTER.

It is the experience of most motorists that tires wear better in the winter than in the summer time. An official of the Fisk Rubber Company explains this by the fact that most of the drivers keep their tires more fully inflated at that time. In the summer they are afraid that the heat will increase the air pressure and cause blow outs, while in the winter they have no such fear. The result is that in summer many tires are kept habitually under inflated, with the result that fabric is worn and cracked by excessive flexing and consequently wears out soon.

MOTORS DON'T HURT BUSINESS.

The idea that the rise of the motor car industry has hurt other lines of business by diverting to itself money that was formerly spent elsewhere is repudiated by H. S. Daniels of the Kissel-Kar company, who points out the enormous number of men that are employed in the automobile

industry and the amount of steel, lumber, rubber, leather, paint and other supplies used.

All of the men employed in connection with the industry patronize other industries, he says, and this in his opinion offsets the expenditure that may be diverted by the purchasers of motor cars.

AN ACUTE MOTOR SHORTAGE.

Dr. L. A. Pulley, Great Falls, Mont., bought a new Jeffery Four some months ago and went with it on a long tour of the western country. He had reached Watrous, N. M., when he was recalled to Chicago. At that time Watrous was clamoring for motor cars and the dealers could not get them from the factories. Instead of shipping his car to Chicago the doctor offered it for sale, with the result that he found a buyer who was willing to pay \$100 more than the original list price of the car.

FRAUD CAMPAIGN PROGRESSES.

Last fall a campaign was begun by the Ohio Motorist, published in the interests of the Ohio automobile clubs, against leagues and schemes that solicit business from motorists under false pretenses. Many such offer standard goods at prices less than the cost of production, although a contract, often unread, provides that if the article desired is not in stock something else is to be supplied. It is said that the standard brands are seldom in stock and that something else, often of poor quality, is delivered. This campaign has been taken up by other associations all over the country and several arrests have already been reported.

NEW PLACE FOR TRANSMISSION.

One of the striking features of the new Marmon design which has created a great deal of comment is the placing of the transmission. It has been the practise to place it either in unit with the motor, in three or four-point suspension in the middle of the frame, or on the rear axle. The Marmon transmission is placed at the forward end of the torque tube, where it is supported by a ball and socket joint. This is said to permit a quieter and more efficient drive and to make for better weight distribution and balance.

THE AMBU ELECTRIC TROUBLE SHOOTER.

WHEN it is considered that in the 50 or more types of electric starting and lighting systems there are 12,500 possible troubles, then the advent of any mechanical means that will enable anyone to locate them certainly and easily is in the nature of a blessing to the motoring world. Such a device has been produced by the American Bureau of Engineering, 1526 Wabash avenue, Chicago. It is called the Ambu trouble shooter and consists of a meter like instrument, and a complete set of index cards and wiring charts.

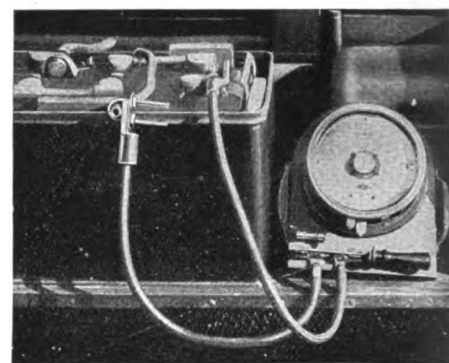
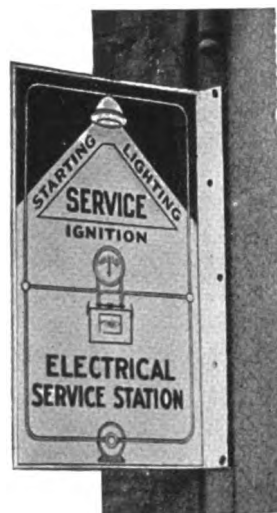
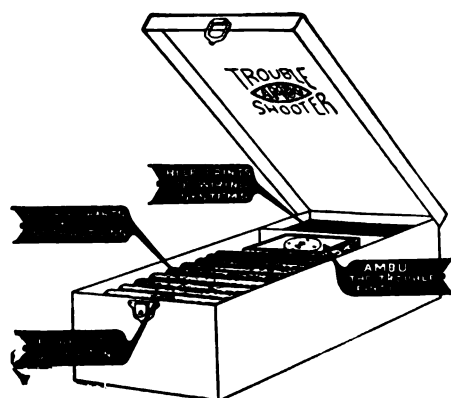
The manufacturer declares that there are approximately 250 places in each lighting and starting system in which trouble may occur, and that Ambu will accurately, automatically, instantly and mechanically locate them even when used by one without particular knowledge of electrical matters. Because of the large number of sources

to the battery cable and the other to the battery terminal. This method of attachment is the same for all makes of cars.

The next step is to find on an alphabetical list of the cars on the American market, which is supplied, the name and key number of the car being worked upon. For example, assume the key number to be 4-5. Then one of the levers would be moved until the figure 4 appears; the other is moved to the figure 5.

With the engine idle and the lamps turned off, look through the lower opening on the dial, where a number will be registered. This is the number of the chart in which will be found the trouble present, together with explicit instructions for remedying it.

The next step is to turn on the lamps, the engine being idle. A number, which refers to the chart in which will be found any trouble present



Units of the Ambu System; Case Holding the Entire Equipment, the Instrument, Charts, Wiring Diagrams and Periodic Bulletins, Shown at Left; the Sign of the Ambu Service Station, at Centre; How Instrument Is Attached for Service, at Right.

of trouble, the repairman or the owner of a fleet of cars or trucks has great difficulty in deciding where to begin the search for the trouble.

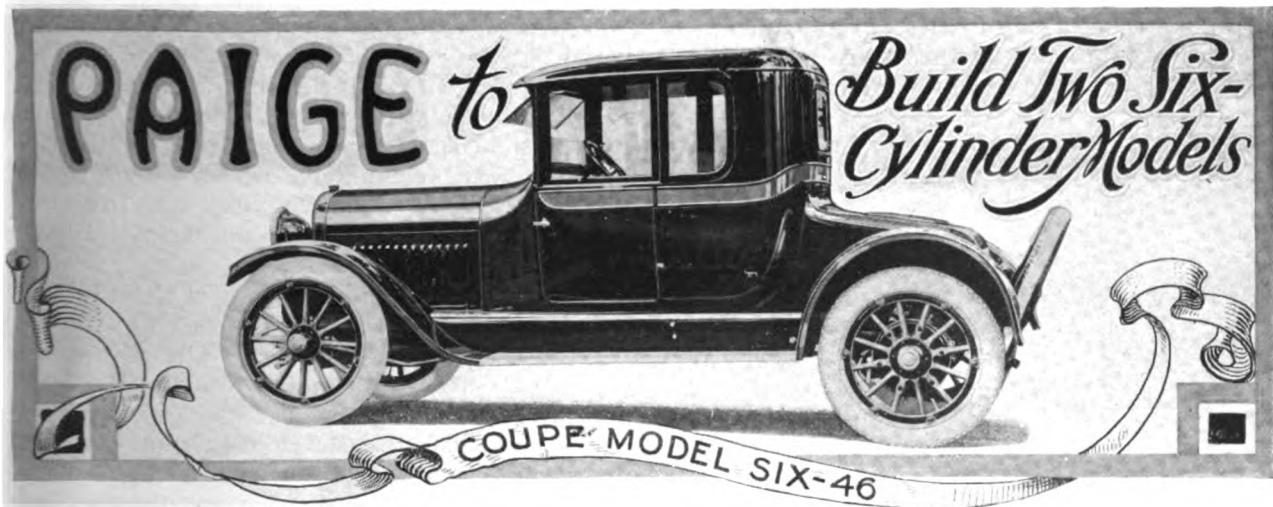
Ambu does more than locate the trouble—it discovers it and then refers the user to a certain index card and wiring chart, where the cause of the trouble and the best means of correcting it is told concisely, but accurately.

The instrument is contained in a polished wood case on top of which appears a glass covered dial. From it extend two heavy wire cables fitted with a special design of universal terminal. At one side are two levers, which adjust Ambu for the car being repaired. After disconnecting one of the battery cables at the most convenient place, one of the large Ambu cables is attached

with engine idle and the lamps on, will appear in the opening at the left hand side of the dial. The last test is to turn off the lamps and start the engine. The key number will appear in the dial opening at the right.

The three tests mentioned have taken into account every part of the electrical equipment and tested both charge and discharge conditions, which is not always possible by other means.

The charts cover each make of electrical equipment fitted as standard on American made cars, as well as the important systems which have not been adopted as standard. For the period of one year the American Bureau of Engineering furnishes each purchaser with data relating to all new developments that may appear.



CONTINUATION of the general policy which it followed during the past year with great success of confining its efforts exclusively to sixes has been announced by the Paige Motor Car Company. The factory was oversold during most of the last season as a result of the popularity of its "Six-46" and of its light Hollywood Six.

The first car has been so successful that it is to be continued through the 1916 season substantially without change, but the lighter car has been redesigned in some details, and enlarged and improved. It is to sell for a price which is \$45 lower.

The great enlargement of the Paige business during the year was the cause of many additions to the company's plant; materials were contracted for ahead and in large quantities; new manufacturing processes were installed and everything possible was done to permit the company to begin its new year under the most favorable conditions.

The new Fleetwood Six is quite similar in most of its details to the larger car, but has been designed for five passengers, while the companion product is meant for seven. The changes and improvements in this car are more marked than in the larger one.

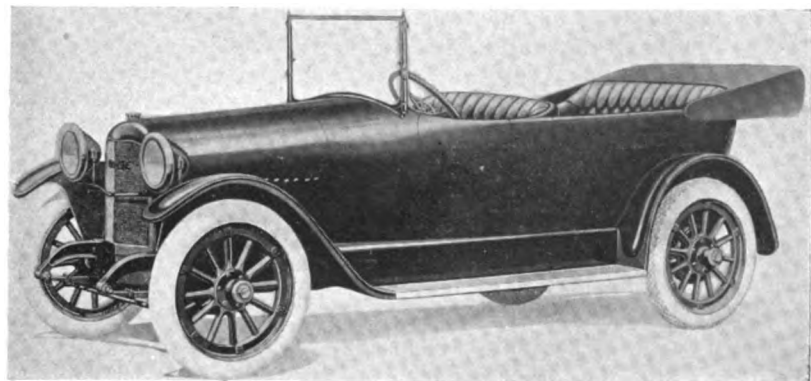
They include a bigger, roomier and more attractive body, a larger, more powerful and more vibrationless motor, and better upholstery, paint and finish. It has the same European streamline body as the more expensive model, full "U" shaped doors, same axle design, clutch, transmission, three-point suspension for the power plant,

control arrangements, radiator design and hand buffed French glaze leather.

The motor of the Fleetwood Six is a six-cylinder, cast en bloc, from special cylinder iron, with a bore $3\frac{1}{8}$ inches by five-inch stroke. There is a separate and removable cylinder head. The bottom of the crank case is sheet steel. The piston displacement is 230 inches and the horsepower according to the S. A. E. formula is 23.5.

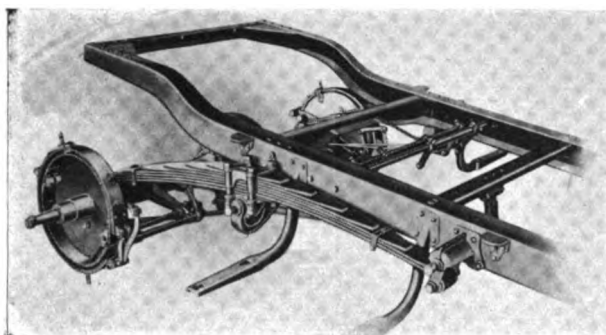
The valves are on the right side and are operated by hardened and ground mushroom tappets. The valve heads are nickel steel welded to .20 to .30 carbon steel stems. All of the valve mechanism is enclosed by pressed steel covers and runs in oil. The crankshaft is a carefully machined drop forging provided with three main bearings two inches long and accurately balanced. The camshaft is a carbon steel drop forging with integral cams and is heat treated. It runs on three bearings, of which the front and centre bearings are die cast, while the one at the rear is of the ball type to take care of the thrust.

The carburetor is a Rayfield fitted with a hot



Paige Fleetwood "Six-38," the New Model.

air intake tube, which carries an adjustment on the dash. Ignition is of the Remy high-tension type with a Remy distributor for current drawn



Cantilever Rear Spring System Used on Both the Paige Models.

from a Willard six-volt battery.

A neatly designed multiple disc clutch with cork inserts is enclosed in the flywheel and runs in oil. It has 14 discs and there are 36 corks in each. The transmission has three speeds forward and reverse and is of selective sliding type. The transmission gears are of chrome nickel steel, heat treated and ground. The shafts are carried on a double row of New Departure ball bearings and Hyatt roller bearings. The oil capacity of the box is two quarts.

The lubrication system is the well known combination of forced feed and splash, and a plunger pump operated from the camshaft forces oil to the main bearings and helical timing gears. The capacity of the system is six quarts.

A centrifugal pump is employed to force the water through the cooling system. The fan mounted at the front of the motor runs on ball bearings. The zig zag cellular radiator is 15 per cent. greater in capacity than the one used on the smaller of the Paige cars last year. Its water capacity is $4\frac{1}{4}$ gallons.

The rear axle is a floating type with axle shafts and differential mounted on Hyatt high duty roller bearings. The propeller shaft runs in a concentric tube, which takes all driving and torque strains.

There are two sets of brakes, which work on steel drums 12 inches in diameter. The brake bands have a two-inch face. One set of brakes is external contracting, while the other is internal expanding.

The front axle is a one-piece, I beam section. It is drop forged and heat treated and the spindles are equipped with ball bearings. The wheels are wood of the artillery type, 32 inches in diameter, with 12 spokes front and rear. They are equipped with demountable rims. Goodyear or Firestone 32 by four-inch tires are standard equipment and non-skids are fitted to the rear wheels.

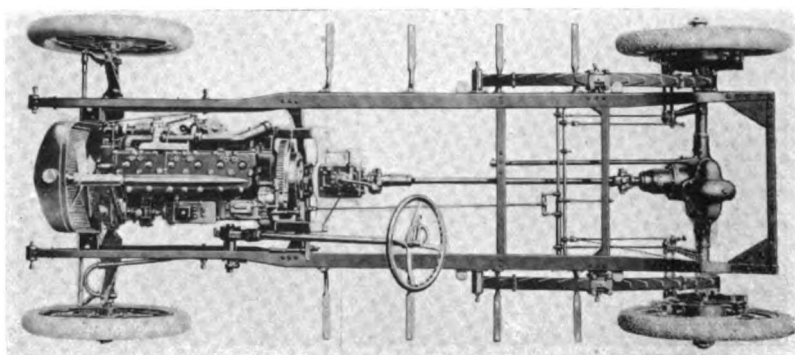
The frame is a high carbon steel channel section $3\frac{1}{2}$ inches deep and with a $3\frac{1}{2}$ -inch flange. It is $\frac{1}{8}$ of an inch in thickness. The frame tapers to a 29-inch width at the front and so permits a short turning radius. The springs are made of a special stock developed for spring making. Those in front are 36 inches long by two inches wide. Those in the rear are of cantilever type and 44 inches long by $2\frac{1}{4}$ wide.

The Steering Column.

The steering gear is a Jacox irreversible screw and split sleeve type, adjustable for all sorts of wear. The wheel is 18 inches in diameter, with a corrugated edge on the inside. The horn button is in the centre of the wheel above the spark and throttle levers. Gasoline is carried in a 14-gallon tank placed in the shroud dash, and is fed to the carburetor by gravity.

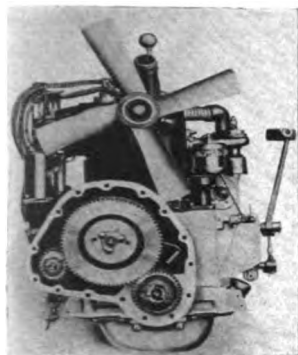
The size of body and the comfort it provides for five passengers are indicated by the following dimensions:

From the front of the seat to the toeboard in the front compartment of the body, the distance is 40 inches; the height of the cushion from the floor, 12 inches; the depth of the seat cushion, 16 inches; the width of the seat cushion inside the upholstery, 46 inches; the height of the back from the top of seat cushion, 16 inches, and the length of the front compartment, 43 inches. The front seat is as wide as many rear seats. It has no centre arm and will seat three persons.



Birds Eye View of Paige Six Chassis, Which Is Substantially Identical for Both Sizes.

In the rear compartment from the back of seat to back of front seat the distance is 44 inches; height of the cushion from the floor, 14 inches;



Front View of Paige Motor.
Showing Timing Gears.

depth of seat cushion, 18 inches; width of seat cushion, inside the upholstery, 47 inches; height of back cushion, 19 inches. The width over all of the front compartment is 50 inches, and of the rear compartment, 55 inches. The width of the floor is 39 inches in front and 43½ inches in the rear.

The standard color is Richelieu blue with straw colored wheels. All metal on all models is trimmed with nickel.

The equipment of the car includes Gray & Davis improved electric starting and lighting system, electric horn, ruby electric light at the rear. The rain vision ventilating windshield is built into the body. The one-man top is made of Pantasote, with a top envelop of the same material. There are Jiffy side curtains, speedometer and demountable rims with one extra rim. Tire carriers are attached to the rear. Tire irons, adjustable foot rest, robe rail, license bracket, pump jack, tools and repair kit are other items of equipment.

WASHINGTON'S SAFETY EXHIBIT.

A Safety First exhibit is to be held at Washington, D. C., Feb. 21-26 inclusive, in which all of the government departments will take an active part. Manufacturers and mine operators from all parts of the country have been invited to attend.

Secretary Lane of the Interior Department has sent invitations to the governors of all the

states asking them to send representatives and asking in addition that the chief mine inspectors, representatives of the industrial commission and other officers charged with collecting statistics be allowed to attend.

In addition to the exhibit there is to be a meeting of state mine inspectors in the office of the Bureau of Mines, Feb. 24.

LUBRICATION OF LONG LIFE.

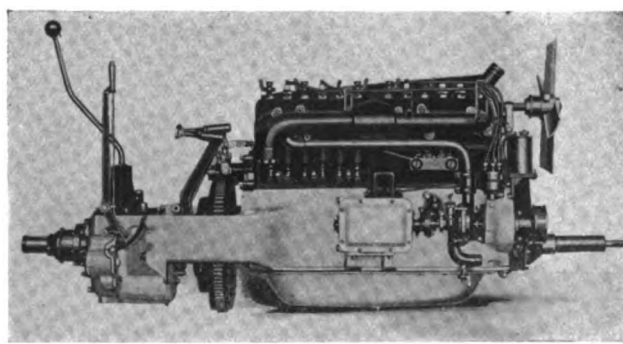
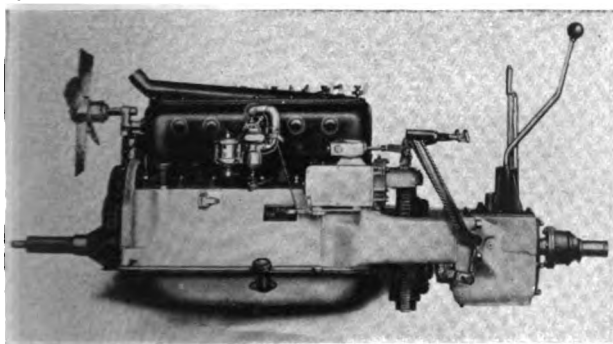
Although there has been rapid development and much changing in motor design, a few cars still use features that were present on their first models. The Marmon cars in 1902, for instance, used a forced lubrication system with a hollow crankshaft and this is still employed. It has been changed in detail and developed, of course, but it is still the same system. Many other cars have adopted it of late years.

ALL-YEAR CAR LIKED IN EUROPE.

Joseph Fluxman, KisselKar representative in Paris, has received a shipment of "All-Year" cars with convertible closed bodies. He declares that they are much admired in Europe. There are no convertible cars abroad to compare with it and although fine coach work is much appreciated and demanded there, the KisselKar is fully satisfactory to European buyers on that score.

EASTERN FARMERS BUY CARS.

It is not only the western farmers who are buying automobiles. According to figures from Pennsylvania, the number of cars owned by farm operators in that state increased 100 per cent. during the past year. Of the 159,984 cars registered there 22,608, or 14.1 per cent., are owned by farmers. Various counties report that from 10 to 18 per cent. of them own their machines.



Paige Six 46 Motor—The Six 38 Is Similar in Design—The Unit Power Plant Is Suspended at Three Points.

NEW ERA LIGHT WEIGHT FOUR AT \$660.

Completely Equipped and Substantial Chassis Is Made To Sell at Exceptionally Low Price—Road Weight Is 1760 Pounds.

ONE of the newest companies to enter the automobile field is the New Era Engineering Company, Joliet, Ill. It has built a substantial, roomy and good looking four-cylinder car of approved design to sell for \$660. Especial attention has been given to reducing the weight of the car and to securing a good balance in accordance with modern engineering endeavor.

The motor is exceptionally light weight, of high efficiency and silent in operation. Cylinders are cast en bloc and all valves are on the right side and enclosed. The two timing gears are helically cut. Bore is $3\frac{1}{8}$ inches and stroke $4\frac{1}{2}$ inches, but at 2200 revolutions per minute the

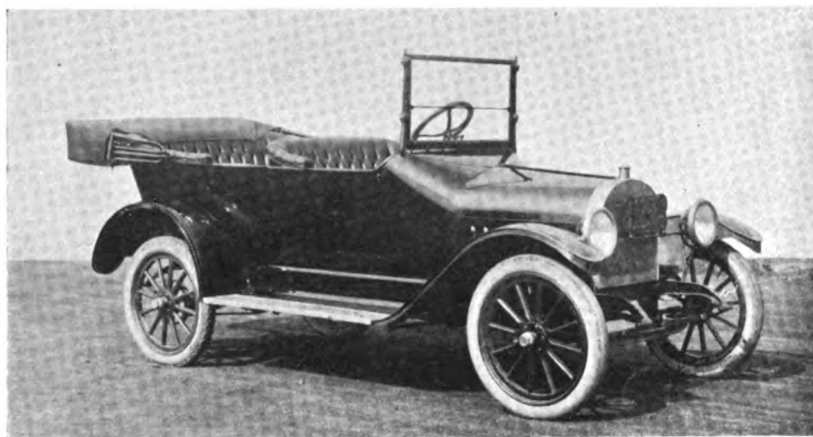
cated under the front seat.

Ignition is supplied by the Allis-Chalmers single-unit starting and lighting system operating through a positive silent chain drive. The electrical unit has the power to spin the motor at 125 revolutions per minute. The starter is operated by a switch on the toe board.

The clutch is a multiple disc type of dry plates lined with Raybestos. Three heavy coil springs are used to insure perfect and efficient contact. The three-speed transmission works on the selective principle and is assembled in a unit with the motor. The gears of the motor are made of chrome nickel steel, heat treated, and run on a double row of Hess-Bright ball bearings.

The 16-inch steering wheel is set on the left hand side of the car for domestic sales and at the right for export. The gear is an adjustable nut and worm. The control levers are set in the centre of the front compartment at the right hand of the driver.

A semi-floating rear axle is used with chrome nickel steel shafts. Hyatt roller bearings are employed. The brakes are double external contracting and internal expanding on rear wheel drums. The braking



New Era Light Four for 1916 Equipped with a 27 Horsepower Block Motor.

motor develops 27 horsepower. It will develop 24 horsepower at working speeds. The gear reduction is $4\frac{1}{4}$ to one.

Cooling is accomplished by means of a cellular radiator, of exceptionally large radiating surface, through which water is circulated by the thermo-syphon system. A ball bearing fan is employed with an eccentric for tightening the fan belt.

A constant level splash system of lubrication is used with a positive oil pump, which delivers oil at both ends of the motor. The oil well is integral with the lower half of the crank case.

The carburetor is a float feed type to which gasoline is supplied by gravity from a tank lo-

surface is ample.

The tread is 56 inches, standard. The wheels are of artillery type and have 12 substantial spokes. They are equipped with demountable rims and nickel plated hub caps. The tires are 30 by $3\frac{1}{2}$, front and rear, with "safety chain tread" on the rear wheels.

The frame is a pressed steel channel section, thoroughly reinforced. A drop forged I beam is used as a rear axle and the wheels are mounted on ball bearings. The front springs are semi-elliptic, fixed at the front end and shackled at the rear. Grease cups are fitted to all spring bolts. The rear springs are full elliptic and are supported by a rocking seat under the rear axles. They

are very resilient and easy riding. All spring leaves are graduated in thickness for the proper duty.

A full streamline body, roomy enough to accommodate five passengers, is provided. The doors have invisible hinges. The instruments are carried in an instrument board in the cowl of the dash. All bodies are perfectly finished and neatly upholstered. The body is made of sheet metal mounted on wood frames.

The color of the body is dark green, relieved by small white stripes. The running gear is black. All exposed metal parts are trimmed with nickel plating.

Included in the equipment is a high-grade silk mohair one-man top with dust boot and side curtains. There is a two-piece, clear vision, rain vision ventilating windshield. The electric headlights are equipped with dimming attachment. The tail lights are electric. All are operated from the instrument board.

Other items are a foot throttle, robe rail, flush type speedometer and ammeter mounted on the instrument board, electric horn, electric light switch and ignition switch. The storage battery is located under the floor, so that a clear running board is preserved. There is a tool kit, jack and pump, extra demountable rim and tire carrier.

The total weight of the car ready for use is 1760 pounds, so that operating expense in tires and fuel should be very moderate.

NOVEL CATALOGUE PLAN.

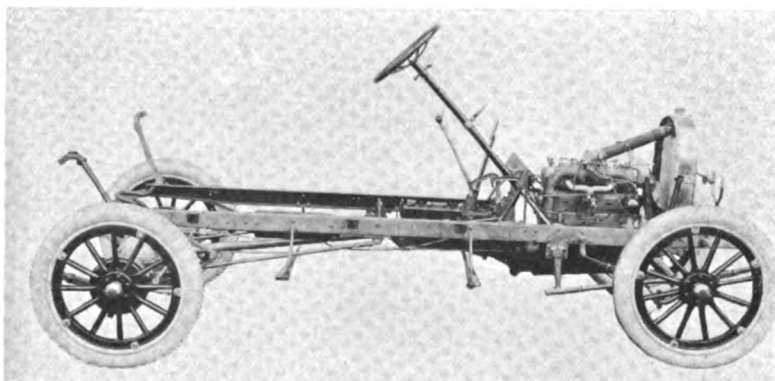
A catalogue skillfully combining an appeal to the engineer, while still making itself intelligible to the lay reader, has been produced by the Norma Company of America, which makes anti-friction bearings that are largely used in magnetos. The first 18 pages of the catalogue give all the facts that make the situation clear to the engineer. The remainder of the book is devoted to interpretation to make the points clear to the non-technical reader. The book aims, in a way, to be a permanent text book of anti-friction bearings. Requests for the publication should be addressed to the company's headquarters at 1790 Broadway, New York City.

HUPP ABANDONS YEARLY MODELS.

There are to be no more yearly models of Hupmobiles, according to J. Walter Drake, president of the Hupp Motor Corporation, but the present car brought out as 1916 model N will be continued indefinitely as series N. Hupp engineers will add new features as they are proved to be desirable and the factory gets ready to put them out.

In this way the company avoids the competition in announcements which had led some makers to begin announcing the next year's models in April and led to pressure by the public and by dealers on all makers to get their new models out as early as possible.

The situation resulting from announcements all through the summer and fall greatly disturbed every body connected with the business and



The Light but Substantial Chassis of the New Era Four for 1916.

caused rapid depreciation in the models that were already in the hands of the customers. The yearly models have already been abolished by many of the makers of the high quality, high priced cars.

PIKES PEAK HIGHWAY MEETING.

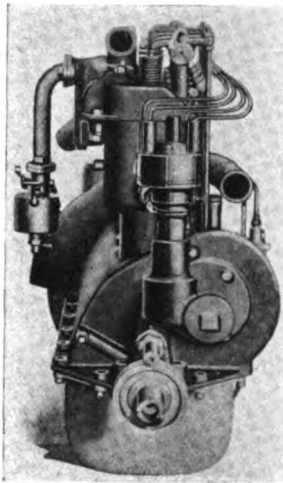
Plans for the further improvement of the Pikes Peak Ocean to Ocean Highway and of its advertisement among the touring motorists of the United States were made at the fifth annual meeting of the Lincoln Highway Association of Colorado, held at Denver, Jan. 19.

Further development of the "See America First" movement is expected by the association and this, in conjunction with the advertising of the State of Colorado, which the association will push, is expected to bring many visitors there and greatly increase the prosperity of the state.

STERLING-NEW YORK IS NEW LIGHT CAR.

Well-Designed, Handsome and Fully Equipped Light Car, Priced at \$595, Embodies Refinement of Design Usually Found In Higher Priced Models.

TO FIT what its makers conceive to be a niche in the market that is as yet unfilled, the Sterling Automobile Manufacturing Company.



End View of the Sterling-New York Motor.

Inc., with factories at Paterson, N. J., and executive offices at 1790 Broadway, New York City, has designed and is offering a light roadster for \$595.

The car incorporates the most modern features of mechanical design. It has a graceful, attractive body, with low centre of gravity and up-to-date lines and is fully equipped. It is a light car for the man who wants an economical vehicle yet is not satisfied with the cars of this type which sell for the lowest prices.

The up-to-dateness of the design is indicated by the fact that the motor used is a four-cylinder, cast en bloc, high speed design, with overhead valves. The bore is three inches and the stroke 4 1/4 inches. The head is removable, giving easy access to the valve mechanism and the pistons. Bearings are of exceptionally ample dimensions. Those of the connecting rods are die cast, thus insuring long life. Camshaft bearings are of bronze.

A system of positive level splash lubrication is provided. Oil is fed from No. 4 pocket to Nos. 3, 2 and 1, and is then returned through a filter by a plunger pump to pocket No. 4. A sight feed on the dash shows the flow of oil at all times.

The gasoline tank is carried under the cowl and it feeds to a double jet Zenith carburetor of the type that is used exten-

sively in European motor vehicle practise.

Battery Generator Ignition Used.

Ignition is of the battery generator system type, the current being drawn from the storage battery, which is kept constantly charged by an electric generator.

The cooling system operates on the thermosiphon principle and has extra large radiator capacity and generous water jackets. The clutch is a large leather faced cone provided with springs beneath the leather to insure smooth engagement.

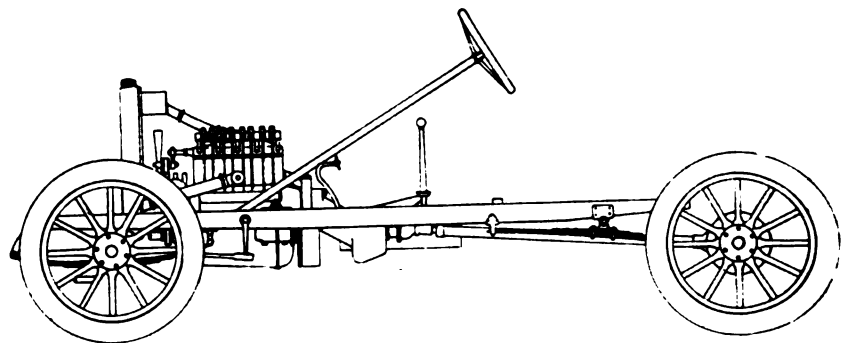
The transmission is equipped with ball bearings. It is the now almost universal selective sliding gear type with three speeds forward and reverse. The gears are made of chrome nickel steel accurately ground to size. The gear control lever is placed in the centre of the front compartment.

A two-unit electric lighting and starting system is employed. The generator is driven by silent chain and the starting motor is equipped with the Eclipse-Bendix drive.

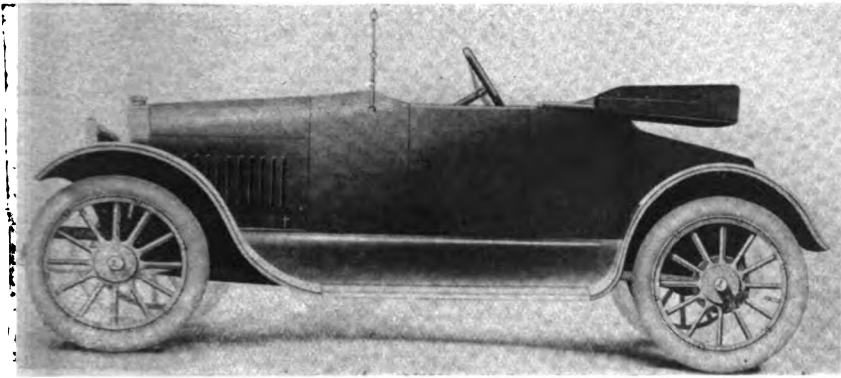
The rear axle is semi-floating and is equipped with ball and roller bearings. The bevel gear, pinion and drive shaft are made of the highest quality chrome nickel steel. The front axle is a drop forged I beam specially heat treated to withstand strains and abnormal shocks.

Cantilever Springs at Rear.

Emergency and service brakes are external contracting and internal expanding on the same rear wheel drums. These drums are lined with Raybestos. An especially noticeable feature are the long Lancaster cantilever springs, a feature



Engineer's Plan Drawing of the Sterling-New York Chassis.



The Sterling-New York Roadster for 1916, Price \$595 Complete.

which combines the best results with simplicity of construction. The front springs are the usual semi-elliptic type.

The wheels are of the wood artillery type, made of second growth hickory in the natural wood finish. They are equipped with quick demountable rims. One extra rim, making five in all, is given as standard equipment.

Tires are 30 by 3½ all around and standard equipment is the Swinehart brand.

A very roomy body of the streamline type, with high sides, is provided. The rear deck provides very ample storage space for luggage. This will be a feature much appreciated by salesmen who travel by motor car or by tourists off on long cross country trips.

Long, graceful crown fenders with sweeping lines are made of extra heavy gauge steel with full skirts and a dust shield. Linoleum covers the running boards.

The electric lamps are 10½ inches in diameter and the focus is adjustable. The light bulbs are of the mazda type and the electric tail light is made up as part of a license bracket.

The windshield, which is included in the

equipment, is a rain vision ventilating type designed to afford convenience to the driver under all conditions of driving.

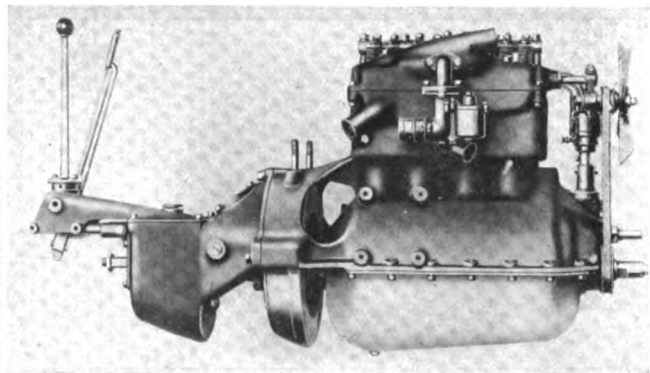
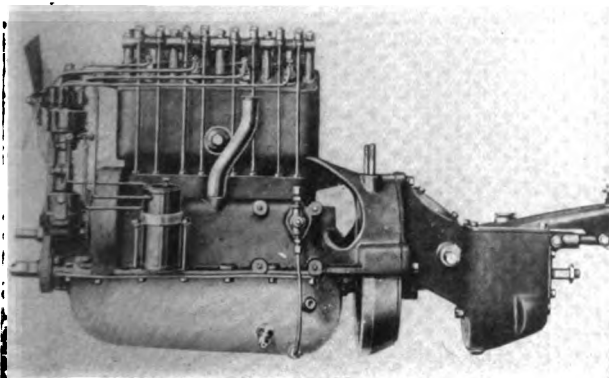
The body is deep and amply spacious to provide the utmost comfort for two passengers. Great care has been taken with the upholstering to insure easy riding. The cushions are 12 inches deep and are supported by large, easy working springs. They are filled with the best grade of curled

hair. The top is of the one-man type, made of the best grade of mohair, and fastens rigidly to the windshield post.

The finish of the body is blue, black or gray, according to the buyer's selection. The car throughout is exceptionally attractive in appearance.

MAKE HARD WINTER DRIVE.

Driving a new Champion car from Detroit to Chicago over the worst of Michigan roads at a time when their condition was of the worst, owing to the January thaw, Stanley and Harry Christian arrived in Chicago after a two days' run. The car was equipped with tires made by the Perfection Tire and Rubber Company, of which the tourists' father is president. These tires are made with an asbestos instead of a cotton fabric. Mud was hub deep most of the way and it was only possible to drive in day light.



Views of Both Sides of the Block Motor Installed in the Sterling-New York Light Car—It is a Four-Cylinder Type, Has Valves in Head and is Provided with Two-Unit Electric Starter.

MOTOR CARS AND THE GASOLINE SUPPLY.

AN EFFORT has been made by the Petroleum News, a trade paper of the oil industry, to forecast the effect of the increase in automobiles on the oil trade and the production of gasoline. The following table shows the number of motor cars in use in previous years, the number of gallons of gasoline consumed and the number of barrels of crude petroleum required to produce the gasoline:

Year	Cars	Gas Cons.	Av. Cons.		Car Crude Bbls.
			Pct. Inc.	Per	
1912.....	677,000	338,500,000	..	500	222,900,000
1913.....	1,010,483	505,200,000	49	500	248,400,000
1914.....	1,253,875	590,000,000	16	470	265,000,000
1915.....	1,754,570	750,000,000	27	427	267,400,000
1916.....	2,500,000	952,600,000	27	380	342,000,000

These figures are conservative in that they take the registration on the first day of the year as the number of cars operated throughout the year, whereas the number increases very rapidly during the early months of the year. The number of cars operated in 1916 will probably be nearer 3,000,000 than 2,500,000.

At the present rate of consumption the United States Geological Survey estimates that the known bodies of crude petroleum will be exhausted by 1937. This consumption will of course be greatly increased and consequently it is necessary that large additional pools of petroleum be discovered and tapped, or that oil be imported.

There are numerous possibilities in the development field. Benzol is a good motor fuel and is being produced as a by-product of coke making in this country in much larger quantities than before and these quantities will increase.

Alcohol fuels are believed to be practical and can be produced in great quantities at low cost once the need becomes pressing and legal arrangements are made. And kerosene, which is now more or less a burden to the refiner, can be used in a kerosene carburetor. The present devices for that purpose, however, are so troublesome that motorists are not likely to care to use them until the price of gasoline compels.

WON'T CREDIT AMERICAN RECORDS.

Since Americans have beaten most of the speedway and other performance records previously made, the Royal Automobile club and

other European motoring organizations have developed a marked disinclination to co-operate with the American Automobile Association in establishing world's records. The American association can register American performances as American records, but the European associations continue to register the records made in Europe before the war as the best, entirely ignoring the American performances.

Thus the Maxwell non-motor stop record of 22,022.3 miles is only an American record. The best previous American performance was 13,000 miles and the best European record, made by the very expensive Rolls-Royce car, was 17,000 miles.

NEW CALIFORNIA REGISTRATION.

A new registration system has been inaugurated by the California state motor vehicle department by which no owner can in the future evade registering his car. A new method of card filing has been adopted whereby the numbers of the cards in the state are grouped. Only a few seconds are required to determine the numbers that have not been registered. Failure to register 30 days after Jan. 1 carries a 25 per cent. penalty. The total receipts in automobile registration fees for 1915 amounted to \$1,963,119. There are now 163,431 cars registered in the state.

COMING EVENTS.

February.

Feb. 12-19—Show, Hartford, Conn.
 Feb. 14-19—Show, Des Moines, Ia.
 Feb. 14-19—Show, Cedar Rapids, Ia.
 Feb. 15-19—Show, Trenton, N. J.
 Feb. 19—Show, Newark, N. J.
 Feb. 19-26—Show, Harrisburg, Penn.
 Feb. 20-27—Show, Grand Rapids, Mich.
 Feb. 21-26—Show, Bridgeport, Conn.
 Feb. 21-26—Show, Louisville, Ky.
 Feb. 21-26—Show, Omaha, Neb.
 Feb. 21-26—Show, Portland, Me.
 Feb. 21-26—Show, South Bethlehem, Penn.
 Feb. 21-26—Show, Syracuse, N. Y.
 Feb. 21-28—Show, Pittsfield, Mass.
 Feb. 28-March 4—Show, Indianapolis, Ind.
 Feb. 28-March 4—Show, Paterson, N. J.
 Feb. 28-March 4—Show, Utica, N. Y.
 Feb. 28-March 4—Show, Watertown, N. Y.
 Feb. 28-March 4—Show, Sioux City, Ia.
 Feb. 29-March 4—Show, Fort Dodge, Ia.

March.

March 4-11—Show, Boston.
 March 8-15—Show, Brooklyn, N. Y.
 March 15-18—Show, Trenton, N. J.
 March 18-25—Show, Pittsburg, Penn.
 March 21-25—Show, Deadwood, S. D.
 March 22-25—Show, Saginaw, Mich.
 March 28-April 3—Show, Manchester, N. H.

April.

April 10-15—Show, Seattle, Wash.

PRACTICAL MOTOR CAR REPAIRS.

SPARK PLUG CUT OUT.

If care is not taken the operator is apt to receive a shock when short circuiting the spark plugs with a screw driver. A better and more convenient method is illustrated in Fig. 143 B. It consists of a small fiber

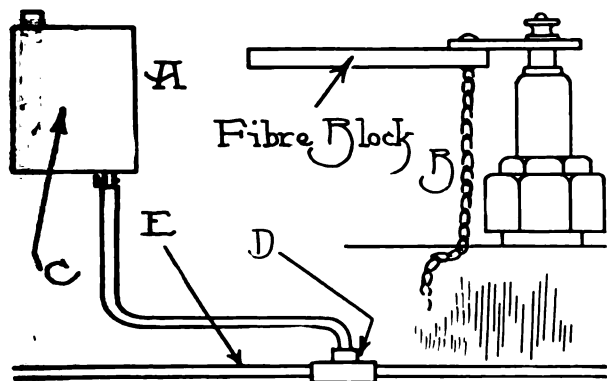


Fig. 143—A, Approximate Proportions and Design of Emergency Tank Suggested; B, a Simple but Practical Spark Plug Cut Out.

block, a short length of chain, a strip of sheet metal and a small stove bolt. The strip of sheet metal is placed on top of the block and the chain at the bottom and both are held together by the small stove bolt. The operation is simple. Let the piece of sheet metal contact with the spark plug and the chain touch the cylinder or any other convenient metal part. This is an easy method of locating missing plugs.

EMERGENCY TANK.

A correspondent writes that he has solved the problem of preventing shortage of gasoline when on the road. The apparatus, as illustrated in Fig. 143 A, consists of a discarded one-gallon oil can (C) mounted on small wooden blocks and securely fastened to the dash. A hole is drilled through the bottom of the can and a shut off valve soldered in place. The main gasoline line is then cut and a small tee joint (D) fitted. A pipe (E) is then run from the top of the tee joint to the shut off valve.

The action is simple. The shut off valve under the small tank is closed and the tank filled with gasoline. Should the gasoline supply become exhausted when on the road, the operator has but to open the valve, which will supply fuel for considerable travel. This arrangement is also handy when operating on grades which cause the gravity flow to cease. When painted to correspond with the dash of the car, the tank presents a neat appearance.

PET COCK OPENER.

It is almost impossible to turn the petcocks on the lower half of the Ford crank case without the operator soiling his hands and clothing. A simple device to remedy this condition is illustrated in Fig. 144 A. It consists of a two-foot piece of quarter-inch wire. The part

which turns the petcock valve is a piece of sheet steel bent in U shape, as shown with a hole drilled in its centre. It is then riveted and pinned on the end of the wire. The other end of the wire is bent to form a handle. If desired the wire at this end may be divided off into inches for measuring the gasoline supply.

PREVENTING DRAFTS.

The windshield used on the Ford car does not snugly fit the top and in cold weather a draft enters through this gap. An effective protection is afforded by the device illustrated in Fig. 144 B. Trimmers' clamps are screwed into the bow of the top. The filler (B), which is made of canvas, is secured to the top by the clamps and to the top of the windshield by spring clamps made of sheet steel. A metal rod is run through a seam formed in the canvas filler to give weight to the device and also to afford a grip for the windshield clamps. In warm weather the filler can be easily taken off by removing the clamps.

JIG FOR DRILLING COTTER HOLES.

Drilling small holes in several rods of the same dimension for cotter pins can be made easier by the use of a jig similar to the one in Fig. 145 C. The device can be made without much trouble or cost, and will save considerable time wherever used. A piece of cast iron is machined true on all sides and a hole the size of the rod to be drilled is bored for almost the entire length. A hole diametrically opposite from this is drilled and tapped to receive a set screw. An aperture is then made through the side of the jig for the drill. The rod is inserted in the device and the set screw adjusted to serve as a top for the rod. With this arrangement a hole can be drilled at any distance from the end of the rod.

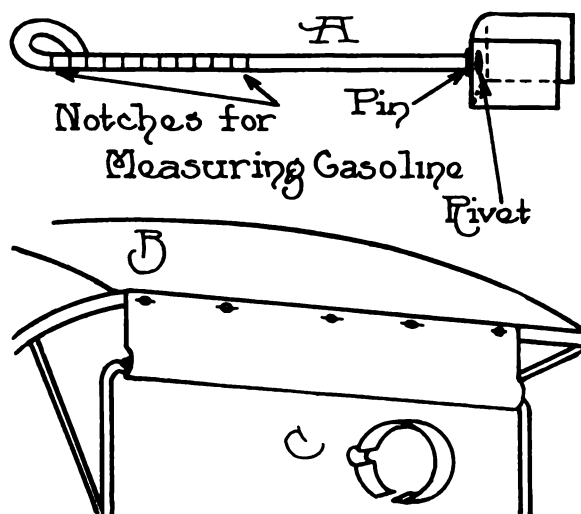


Fig. 144—A, Handy Instrument for Ford Car Owners; B, Device to Check Drafts at Top of Windshield; C, Spring Clamp.

EMERY WHEEL GUARD.

A substantial guard for a small emery wheel that will protect the workman's eyes is illustrated in Fig. 145 B. It consists of a piece of sheet metal about four

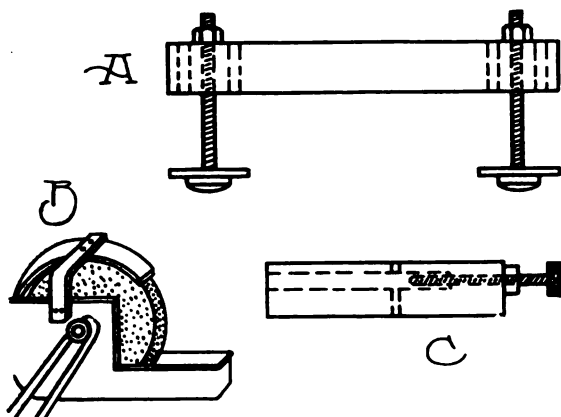


Fig. 145—A, Flywheel Puller; B, Emery Wheel Guard; C, Jig for Drilling Cotter Holes.

inches in width and 14 inches in length. The metal is bent to conform to the shape of the wheel. The guard is supported by a strip of steel riveted to the top and bolted to the frame work of the machine.

FLYWHEEL PULLER.

Many cars have a flywheel that has been forcibly pressed on the crankshaft and is retained by a nut. With this type of construction, much difficulty is often encountered when it is necessary to remove the wheel from the shaft. The device shown in Fig. 145 A is especially designed for this purpose. The cross bar is made of three-inch square steel and several holes are drilled near the ends so that the bolts may be moved to fit the flywheel. The action is quite simple. The flywheel retaining nut is removed and the cross bar placed against the end of the crankshaft. The bolts are placed through the spokes of the flywheel and then a flat piece of steel placed on the bolt and against the spokes. By turning the nuts on the bolts, the tendency is to force the flywheel off. When it is exceptionally hard to move, a sharp blow struck with a hammer on the cross bar at a point opposite the crankshaft, will greatly assist the operation.

VALVE SPRING COMPRESSOR.

In Fig. 146 is shown a practical valve spring compressor that was made by a repair man during his idle moments. It consists of a curved piece of steel (A) with a slot cut in its lower end. This curved member is inserted in the valve cap, the lower portion bearing against the head of the valve and the slot against the cylinder head. A slot is cut on the inner side of the piece so that a chain can be attached. The chain (B) is of the ordinary steel type, which can be purchased at any hardware store. The lever is an 18-inch piece of flat steel, one end of which is fork shaped. A slot (C) is

formed in the side of the lever to engage a link of the chain. The manner of appliance is shown in the illustration.

HOT SAND BAG.

A valuable adjunct to any car's equipment at this season of the year is a sand bag that can be used to warm up the intake manifold. It should be made of heavy fabric and about a foot long and quite narrow, much like a large sized salt bag. On cold mornings, when the motor fails to respond readily, sand, which has been heated in an oven, can be placed in the bag and the whole placed on the intake manifold. This will greatly facilitate starting. The sand bag can be carried in the car and if its services are required on the road it can be heated on the muffler of any motor car that happens along.

PRESERVING DRY CELLS.

The life of a dry cell is greatly shortened if the cell is left in a damp place. A simple way to insure longer service is to place it in a glass jar that is a trifle wider and taller than the battery. A layer of dry saw dust should be placed in the bottom of the jar and the cell placed on it. The sides are then packed with some material to within about half an inch of the top. Waterproof wires are then secured to the binding posts and hot paraffin poured over the entire cell. A mark of some kind should be made so that the poles of the cell may be easily distinguished. A battery treated in this manner can be fully submerged in water without damage.

HANDLING LARGE WHEELS.

Anyone who has attempted to replace a heavy truck wheel on an axle knows what a difficult task it is. The owner of four large trucks writes that the method shown in the accompanying illustration can be used to advantage for this purpose. A small runway is made of a piece of wood about 12 inches wide and formed like a wedge, so that one end is six inches higher than the other. About every three inches small cleats are screwed horizontally across the surface of the runway. The complete assembly should be well greased. It is

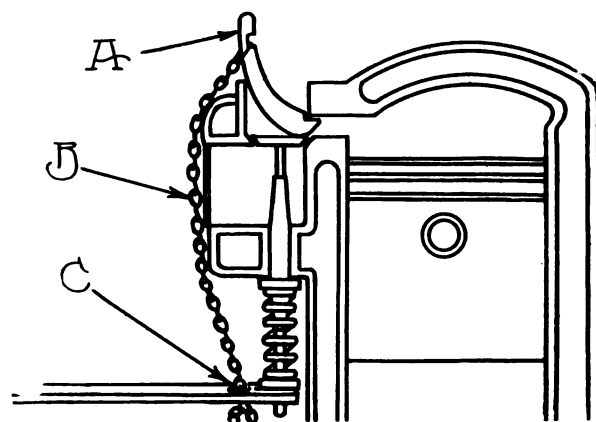


Fig. 146—How to Construct and Operate a Valve Spring Compressor.

then a simple matter to replace the wheel. The runway is placed almost opposite the end of the truck axle, and the wheel is turned up the runway to a point opposite the end of the axle and is slid on. It is stated that with

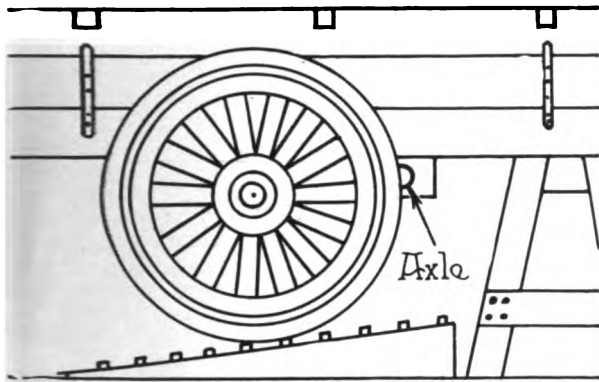


Fig. 147—A Simple Way to Replace Heavy Truck Wheels on Their Axles.

this device one man can replace a heavy truck wheel unassisted.

KNURLING WITH A THREADED TOOL.

Parts could be handled more conveniently if they were knurled on the surface. If no knurling tool is at hand the operation may be accomplished in the following manner. Place the part in the lathe and gear the machine to cut about 20 threads to the inch. The gears can then be changed to cut a left hand thread of like number to the inch and over the right hand thread. When a V shaped tool is used the edges of the cuts are square and sharp and produce as good if not better work than can be accomplished by the regular knurling tool.

REPAIR OF THE SHOE.

When a small cut in a shoe causes a portion of the tread to separate from the fabric, a suitable repair can be made by the use of a small vulcanizer. Prop the loosened portion open with a stick and thoroughly clean the cavity with gasoline. Apply two or three coats of rubber cement to the fabric and inner side of the tread. When this is dry, the tread can be pressed to the fabric and a vulcanized patch placed over the cut.

LOOSE LICENSE PLATES.

When a loose license plate swings against the bracket or other part of the car, a piece of leather or linoleum should be riveted to its back, as shown in Fig. 148 B. This will not only silence the noise, but will save the finish from being marred.

FINDING DEAD CENTRE.

There are several methods in vogue for the finding of the dead centre of a cylinder when the flywheel is not marked. One of the simplest and most accurate is shown in Fig. 148 A. It consists of a length of rubber tubing, one end of which is placed over the top of an open relief cock and the other end placed in a tumbler filled with water. The motor is turned over very slowly by the hand crank when the cylinder is exhausting. The

gases forced from the cylinder by the upward travel of the piston cause bubbles to appear in the tumbler. When the bubbles cease to appear it is proof that the piston has reached the end of its upward stroke, or in other words, is at top centre.

FREEING FROZEN PISTON RING.

When a piston ring becomes "frozen" to the piston through lack of lubrication, it is often a difficult problem to remove it without breaking. An owner who has had this trouble overcame it in the following manner: Remove the piston from the cylinder and disconnect the connecting rod. The piston should be stood on two bricks laid lengthwise and about two inches apart. The flame from a blow torch is then applied to its head until the metal is brought to a red heat. After the piston has been allowed to cool slightly, a little kerosene is applied to the seized ring. This method will free even the most stubborn ring.

STRAIGHTENING BENT FENDERS.

The only correct and workmanlike method of straightening bent fenders is to remove them and have them rolled by a tinsmith or other metal worker. This operation generally involves considerable labor and delay. If the car owner wishes to do the work himself, satisfactory results can be obtained by placing two pieces of thin wood or sheet metal over and underneath the fenders and tightening a clamp at the point of bend. The position of the clamp should be changed several times until the bend is eliminated. This will give a better result than can be obtained by hammering.

A careful driver can reduce the expense of operation by using the throttle instead of the brakes to slow down the car. By closing the throttle the compression strokes of the pistons offer resistance to the momentum of the car and will gradually but quickly reduce the speed so that only a slight application of the brakes is necessary to bring the car to a stop.

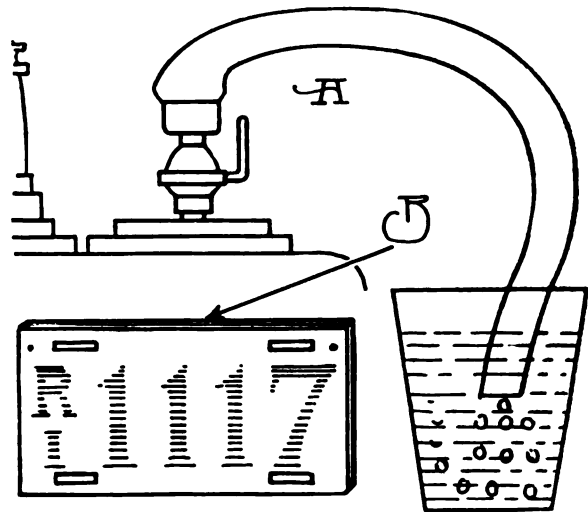
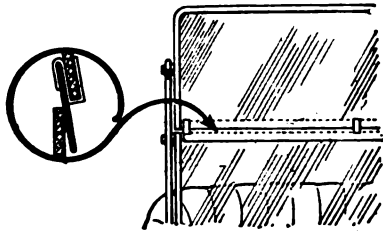


Fig. 148—A, Novel Method of Finding Dead Centre of Cylinder; B, Preventing Loose License Plates from Rattling.

CAR ACCESSORIES AND EQUIPMENT.

CLEAR VIEW RAIN GUARD.

The Clear View rain guard shown in the accompanying illustration, is manufactured by the Clear View Rain



Guard Company, 205 West Lombard street, Baltimore, Md. It consists of a flexible, transparent strip, designed to clip to the lower edge of the top glass of the windshield. Its purpose is to fill the crack between the upper and lower glass of the clear vision windshield, and prevent rain from working into the driver's compartment.

Statement is made that the harder the rain beats against it, the tighter it becomes. It can be attached or detached almost instantly. The selling price is \$1 each.

SPEEDISTIMER.

The latest type of speedometer manufactured by the Van Sicklen Company, 14 Chicago street, Elgin, Ill., incorporates an Elgin watch time piece. It is listed as the Speedistimer.

The speed and distance instrument is identical with the regular standard equipment, but the Elgin watch combination is attached in rather a unique manner. The watch dial is set in the main dial of the instrument and connected by a shaft with the watch

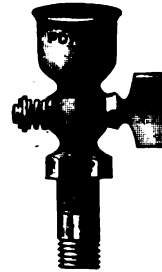


works at the back, which can be removed by merely unscrewing a cap which holds it in place. The wind and

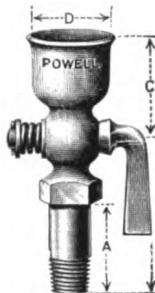
reset of the instrument is operated from a watch stem, in the same manner as the common watch. The watch combination can also be wound and reset from a knurled button projecting through the collar, directly under the watch dial.

NEW PRIMING CUPS.

The priming cups illustrated herewith are manufactured by the Wm. Powell Company, Cincinnati, O. These are of new design and it is said that



the jarring and jolting of the machine has no effect on them. Spring tension maintains a close fit of the plug key to its bearing at all times. The hole

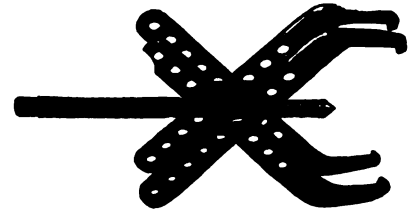


through the plug key is at right angles to the lever or tee handle and is of sufficient diameter to be used as a relief when necessary. The spring is placed between two washers and is secured by a cotter pin. This construction allows the cup to be quickly disassembled.

The elbow style of cup can be obtained in rights or lefts, the illustration showing the latter style. As in all articles bearing the Powell trade mark, these cups are sold under an absolute guarantee of mechanical perfection and superior workmanship. This company also manufactures a complete line of valves, lubricators, oilers, grease cups, etc.

GEAR AND WHEEL PULLER.

The Premier Little Giant wheel and gear puller is a practical device which saves time, labor and annoyance when



removing obstinate gears, pulleys and wheels. It is so constructed that the harder the pull the tighter is its grip. The puller is made of drop forgings throughout and is quickly adjustable up to 13 inches. It cannot twist while being used and removes gears and wheels without trouble. The Premier Electric Company, 4039 Ravenswood avenue, Chicago, manufactures it and will supply further information when requested.

SELF-WINDING AUTO CLOCK.

The Hartford Clock Company, Hartford, Conn., is producing a new, seven-jewelled, self-winding automobile clock, which is said to have withstood a series of tests covering a period of more than four years. Among the advantages claimed for this time piece is the mounting composition in an inner case, allowing no metallic connection between the case and the movement. This is designed to absorb direct vibration and shock and also to act as an additional protection against dust, moisture, heat and cold. The



setting device is reached by removing the bezel, an arrangement intended to prevent persons from tampering with

the clock, as well as to protect it from dust.

All contact troubles are said to be



eliminated by the use of non-arcing, non-corroding, intermittent, self-polishing contacts. The clock is very accurate on account of the uniform spring tension, which is replenished electrically every minute.

The timepiece runs well on any voltage up to 30, while all popular finishes of dials and cases will be made. The price is \$10.

ALLWON MOTOR GLASSES.

"Optical shock absorbers" is what the manufacturer of the Allwon two-color motor glasses calls them. These glasses have two-color lenses of single pieces of glass, one part of which is colored dark enough for the brightest lights and the other part left light enough for ordinary use. They are not two lenses joined as one. The color is introduced into the glass and becomes part of it and is as lasting as the glass itself.

The surface is not disturbed and every part of the lens is clearly transparent, although of different colors or tones.

The frames of the Allwon motor glasses are made to suit all requirements. All prices include a handsome, substantial case.

They are manufactured by Strauss



& Buegeleisen, 489 Fifth avenue, New York City. Prices may be had from the manufacturer upon request.

NEW NORMAN OUTFIT.

The Norman Garment Company, Inc., 32 Union square, New York City, makers of automobile coats, has just announced a new coat and cap outfit made of leatherette, and especially adapted to automobile use.

This outfit weighs 18 ounces. It is made without a rubber compound, which the company states gives durability for warm and dry weather, as well as rainy or cold. The maker's guarantee provides against cracking, peeling or turning hard. The new outfit is made for both men and women in all sizes.

The goggles on the hat are adjustable to the position necessary when driving and when not in use they can be hidden in the hat. If these garments become soiled by dust or grease



the spots can be removed with a damp cloth. The manufacturer will supply further particulars and prices.

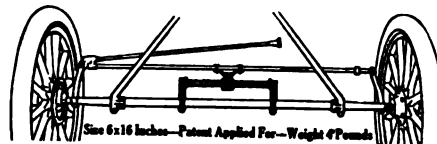
ACME STEERING CONTROLLER.

The Acme steering controller for Ford cars is designed to hold a car automatically in a straight ahead course regardless of the roughness of the road. The maker also declares that it will absorb, not resist, all shocks upon the wheels, will minimize stresses upon the steering gear, and will result in increasing the tire mileage by 20 per cent. It is so constructed as to obtain full turning radius without strain upon the steering apparatus.

Another noteworthy feature is that by automatically holding the car on a straight course the occupants of the car are not in danger of injury should the wheels buckle or the steering gear break. This automatic feature also means that the driver is relieved of much strain of driving.

The device is attached to the front axle and the tie rod, as shown in the

illustration, and can be installed easily by any one in a very few minutes. It does not detract from the



appearance of the car and is guaranteed to give perfect service during the life of the car on which it is installed.

Manufactured and sold by the Acme Steering Device Company, Turk's Head building, Providence, R. I., and 1225 Filbert street, Philadelphia, Penn. List price, \$3.50.

PRECISION BALL BEARINGS.

The Norma Company of America, 1790 Broadway, New York City, has published a valuable treatise on the subject of ball bearings. It is a 124-page book containing diagrams, photographic reproductions and tables that serve to enhance the value of the text which has educational value to every motorist. While naturally some part of the book is devoted to the company's product, a large share is given over to general ball bearing practice. Further information can be obtained from the company.

C-CLEER FOR WINDSHIELDS.

C-Cleer removes one of the most dangerous conditions that confronts drivers of motor cars, locomotives, trolley cars and similar swift moving vehicles. It is a compound designed to apply to the windshield of the motor vehicle to shed rain, snow, steam and moisture so that the driver can see clearly ahead of him at all times. It does not collect dust and is very satisfactory and economical, coming in the form of a simple paste. When rubbed lightly on the glass it will keep it rain proof for an indefinite period. The Sole Manufacturing Com-



pany, 258 Broadway, New York City, manufactures it. The price is 25 cents a can.

INDUSTRIAL HAPPENINGS AND COMMENT.

THE Hyatt Roller Bearing Company's factory at Newark, N. J., now has an elaborate code of safety first rules. The rules pertain to every operation. The first aid room is as fully equipped as a miniature hospital. There is a first aid corps of 17 men, and all workers are instructed to report to one of them immediately they are injured, even if the injury is but a slight scratch. The corps has a very complete equipment, which includes the first pulmotor installed in Newark and vicinity.

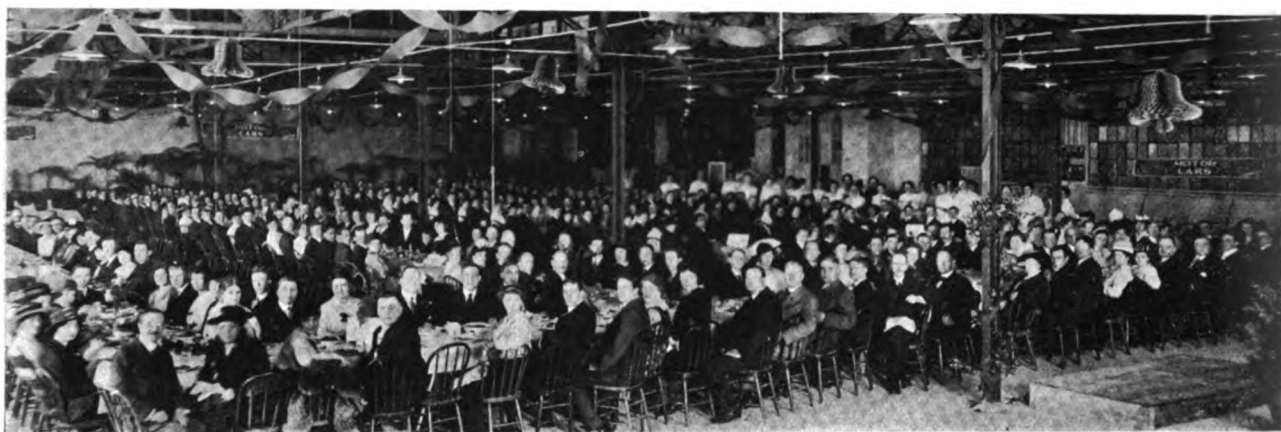
The Willys-Overland Company entertained as its guests 143 Overland dealers from all parts of the northwest at the Toledo plant on Thursday and Friday preceding the opening of the Chicago show. The visitors inspected the huge plant, as well as the Electric Auto-Lite and the Tillotson Manufacturing companies, and then went by special train to Chicago.

The Hudson Motor Car Company's plant at Detroit was the scene of an accident recently. The second floor of the double stock room caved in shortly before noon and tons of motor car parts were precipitated to the first floor. No one was injured, but the damage amount-

pany's line of wrenches, special tools, dies, machinery, bells, stamped steel reels, beams and spools and sheet metal stampings. A valuable feature of the book is its rapid reference index, an adaptation of the system employed in some railway guides. The catalogue is attractively printed and illustrated and contains 199 pages of valuable information.

The Packard Motor Car Company, Detroit, announced recently to its 12,300 employees, through its vice president, Alvan Macauley, that hereafter promotions to positions of importance will be given to only those who are native born or naturalized citizens of the United States, or those of foreign birth who have relinquished their foreign citizenship and who have filed with the government their first papers applying for citizenship and will follow them up with their second papers. Those affected adversely by this ruling will not be discriminated against in their present positions, but they will not be promoted. About 50 per cent. of the men on the Packard working force are of foreign birth.

The Eisemann Magneto Company, Brooklyn, N. Y., this month begins deliveries to the Pierce-Arrow com-



View of Guests at the Allen Motor Company's Banquet, Given Recently in Its New Chassis Assembly Building in Fostoria, O.—About 450 Employees, Stockholders and Friends Attended—Of the 32,000 Square Feet of the Floor Space, 25,000 Were Given Over to the Banqueters—W. O. Allen, General Manager, Eulogized the Automobile as a Transcendent Economic Factor in Modern Life.

ed to several thousand dollars.

The Colonial Automobile Company, Indianapolis, is giving signs of great activity, which is taken to indicate that a new car model is to be marketed. Whether it will be a four, six or 12 cannot be determined at this time, but definite news is expected soon.

The Hartford Machine Screw Company, Hartford, Conn., has been awarded contracts to supply Master engine driven tire pumps as standard equipment for 1916 on National, Marmon, Jeffery, Apperson, McFarland and Owen magnetic cars.

The Grant Motor Company, Findlay, O., has laid plans for a production of 10,000 cars during 1916. To meet the demand for space and facilities the company recently completed additions to its plant that give 25,000 more square feet of floor space. The company reports extraordinary interest and business at the automobile shows at which it has exhibited its six-cylinder model.

The Frank Mossberg Company, Attleboro, Mass., has issued its new 1916 catalogue, which features the com-

pany on its contract for type EM4 dual Eisemann magnetos, which have been adopted as standard for the Pierce-Arrow five-ton trucks. When this contract was first announced it was understood that they were to be used on the three-ton models, which is incorrect. The two-ton Pierce-Arrow trucks will be equipped with Eisemann water proof magnetos, type G4.

The B. F. Goodrich Company, Akron, O., reputed to be the world's largest rubber manufacturing plant, is being increased by the addition of three large buildings. One of these is a finished goods warehouse, 320 by 280 feet, one wing of which is six stories high, and another seven stories. The second will be used for manufacturing and storage and is six stories high and measures 300 by 100 feet. The third, a machine and pattern shop, is five stories high and is 260 by 100 feet. The Goodrich plant comprises 57 buildings, covering about 100 acres. A trip through the whole plant would constitute a walk of about 50 miles, while to walk around it once would make a journey of 3.8 miles.

SUGGESTIONS FOR THE FORD CAR OWNER.

Removing the Combustion Head of the Engine and Cleaning It and the Pistons, Valves and Ports of the Accumulated Carbon as Overhauling Progresses.

The 41st article dealing with the operation, construction, maintenance, care and repair of the model T Ford chassis is the second of a series that deal with adjustment, restoration and overhauling.

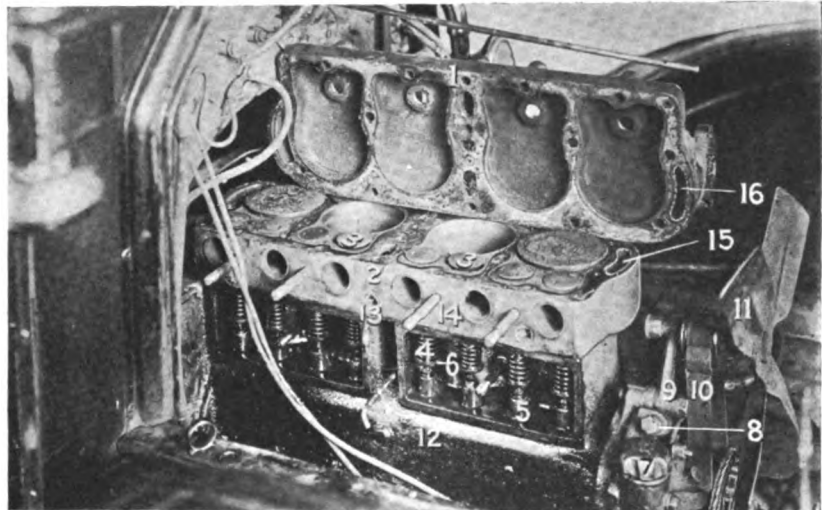
REMOVAL of the cover from the timer is without disconnecting the primary wiring from cover or from the transformer coil box terminals, but the secondary wiring terminals are detached from the spark plugs, which leaves the coil terminals so that they may not be confused. The primary cables are enclosed in what is known as a "loom," this being a sheath or shield in which they are protected from oil, grease and water. The loom is flexible and may be bent to such an extent as may be necessary in handling or attaching or detaching.

The cable is covered with different colored insulation for convenient identification, No. 1 being black, No. 2 red, No. 3 blue and No. 4 green. The cover of the timer carries the four terminals to which the primary wiring is connected, and these are, in the order of firing, beginning at the upper terminal at the left side of the timer, No. 1, No. 3, No. 4 and No. 2, while the coil terminals from left to right, for both the primary and the secondary wiring, are numbered 1, 2, 3 and 4.

When the 15 cap screws that secure the cylinder head have been loosened and taken out the cylinder or combustion chamber head may be taken off so that the pistons and valves may be exposed. There is a copper-asbestos gasket between the head and the cylinder block, for there is necessity of having a perfectly gas and water tight joint between the two. There are three passages from water jacket of cylinder block to the cylinder head, at either end and at the centre, and around these and wherever the two parts would contact the gasket is fitted to securely pack the joint.

There is practically no water pressure, but there is a cylinder pressure of from approximately 60 pounds at the top of the compression stroke to about 250 pounds during the explosion stroke, and this must be resisted by the gasket. As the cylinder block and the cylinder head will contract when cool and expand when heated, there is varying degrees of pressure upon the gasket, and the head must be securely seated upon the gasket to insure against leak and the loss of compression and reduction of the expansion of the explosion stroke.

The gasket is composed of a sheet of asbestos



Ford Engine with Cylinder Block Head Removed. Showing the Deposits of Carbon in the Combustion Heads, on the Pistons and Valves, and Around the Cylinders.

- 1—Cylinder Head.
- 2—Cylinder Block.
- 3—Partly Lifted Valve.
- 4—Valve Spring.
- 5—Valve Tappet.
- 6—Valve Spring Collar.
- 7—Breather.
- 8—Fan Bracket Adjusting Bolt.

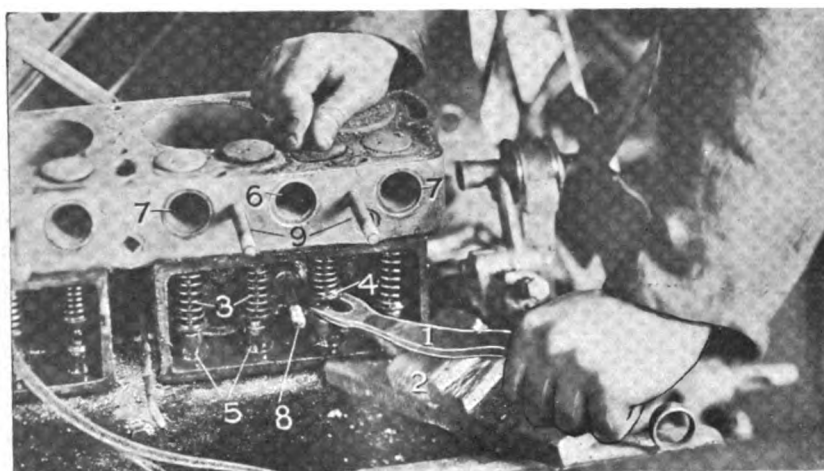
- 9—Fan Bracket.
- 10—Fan Belt.
- 11—Fan.
- 12—Crank Case.
- 13—Exhaust Manifold Seat.
- 14—Inlet Port.
- 15—Cylinder Block Water Outlet.
- 16—Cylinder Head Water Inlet.

fabric between two thin sheets of copper, and while it is not resilient it may be considerably compressed so that it will uniformly conform to and fill all inequalities in the surfaces of the head and the cylinder block. The condition that may be met with in removing the cylinder head will differ somewhat with the manner in which the gasket was originally placed. If the gasket

has never been removed it may be found to be in such condition that it is practical to use it when the engine is reassembled.

How the Gasket May Be Found.

The gasket may have been covered with a light coat of cylinder oil, which was used so that the copper could spread slightly as pressure was applied by screwing down the cap screws, and to compensate for the compression of the asbestos. Were the two metals in contact without the lubricant there would be no probability of the copper spreading, and there might be inequality that would possibly result in leakage. In the event that oil had been used the gasket can be easily lifted from the head of the cylinder block with a thin blade, such as that of a putty knife, and there is little probability that it will adhere to the cylinder head.



Removing the Valve Springs with Simple Tools.

- | | |
|-------------------------------|-----------------------------|
| 1—Valve Spring Lifter. | 6—Inlet Port. |
| 2—Wooden Blocking. | 7—Exhaust Port. |
| 3—Released Valve Springs. | 8—Valve Chamber Cover Stud. |
| 4—Valve Spring Collar Raised. | 9—Manifold Stirrup Studs. |
| 5—Valve Tappet Guides. | |

If, however, the gasket had been removed, it might have been replaced with a thin coating of shellac on the top and bottom, because it could not be compressed to the same degree as a new gasket, and the shellac would serve to fill the surfaces of the iron cylinder block and the cylinder head and the gasket and insure a satisfactory joint. When coated with the shellac the gasket will probably adhere to the block and so care will be necessary to remove it without breaking. Generally speaking, however, there ought to be little difficulty experienced in removing the gasket intact.

May Be Used Again if Not Broken.

With the cylinder head loosened it may be removed readily from the block, and when this is

lifted the gasket will in most cases be found on the cylinder casting, in much the same condition as that seen in the accompanying illustration. This gasket has been used and had been replaced with shellac, which is evidenced by the somewhat roughened appearance of the gasket as it is seen on the top of the cylinder block. The gasket can be used when the engine is reassembled if it is not broken, and for that reason care should be taken in removing it.

Examination of the illustration will show that carbon has accumulated all over the interiors of the combustion heads, the heads of the pistons, the valve heads and the areas about the valves on the cylinder block that constitute the bottoms of the valve chambers. This was a sufficient deposit to cause preignition and the usual complications from carbonization. One can note the outline of

the carbon formation on the cylinder block where the gasket was removed, and observe that it was of considerable depth. The carbon was in largest volume on No. 4 piston, which is evidence that that cylinder received the most liberal lubrication, and there were heavy accumulations on the valve heads, but not sufficient to fill the holes drilled for the tongues of the regrinding tool. There are also deposits about the spark plug holes in the cylinder head casting that are distinctly noticeable.

The condition of this engine was not unusual as compared with others of the same type after a period of use, but there

was sufficient carbon to cause more or less trouble, and as a matter of fact this did result in pounding because of the ignition of the gas from the incandescent points of the deposits. With the removal of the cover plates of the valve chambers, the walls, springs, valve stems and tappets were found to be thickly covered with oil that had worked by the tappets into the chambers despite the breather of the crank case, and while this did not seemingly affect the valves to any appreciable extent, the result of this accumulated lubricant was by no means beneficial. When the cover plates were removed some water flowed from the chambers, this having found its way into them from either washing or exposure to rain.

The next operation was the removal of the valves from the ports. There are many ways of releasing the valves. Various tools, many of them patented, have been devised for this work, because the springs are under tension and they must be further compressed to remove them. The valve stems extend from the heads through guides in the cylinder block until the heads are seated in the ports, and the springs at the upper ends encircle the lower ends of the guides, while the lower ends are seated on collars about the stems, the collars being retained by flattened pins or keys that are niched in their length for the width of the stems. When the pins are in place the pressure of the springs hold them and they cannot be withdrawn until the springs are compressed and the collars raised so that the pins may be lifted and drawn out.

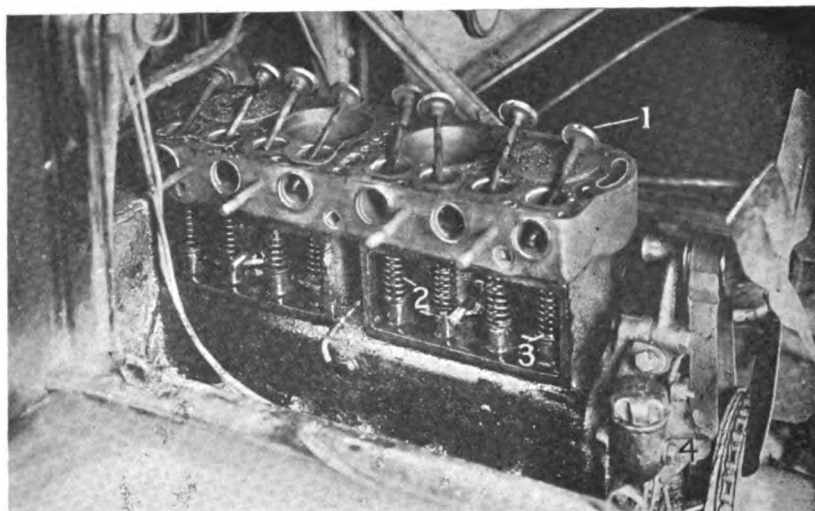
Differing forms of tools are used as valve spring lifters, practically all of which have one member with a forked end or jaw that can be placed under the collars of the valve stems, and some with two such members, that are pivoted like pliers, of such length that considerable leverage can be obtained by pressure upon them. Those with a single-jawed member are sometimes used with a chain and hook that can be adjusted for various lengths, the hook being placed on the top of the cylinder block or on an exhaust or intake manifold stirrup, and the others are used much like tongs or pliers, the forked ends being placed under the collars and into the coils of the springs.

Handy Home-Made Tool.

While valve spring lifters are a very convenient tool to have when the work of this kind is to be done, the type that was utilized in this work was a substantial length of flat steel with a rather wide fork forged at one end, and it was slightly curved so that good leverage could be obtained on a comparatively flat surface by rocking or pressing the other end. Instead of the chain and hook or other fittings that might be a part of a special tool, this was used with a section of pine board about 15 inches long and four inches wide. On this, about four inches from one end, was nailed a block of wood about four inches square and an inch and a half thick that served as a ful-

crum. This wooden base was seated at one end on the crank case and the other on the chassis frame, and on this the tool was rested, the jaws placed under the valve spring collars and the springs lifted quickly and with quite as much certainty as could be desired.

One advantage of the tool was that it could be worked from either side of a valve stem as readily as from directly in front, there was no possibility of it slipping, and it could be used equally well at any time. In the photograph the work man is standing in front of the chassis and using his left hand to depress the lever merely to demonstrate the use of the tool. Practically working he would stand at the side of the chassis and use the tool with his right hand, removing the keys with his left. One will note that the pic-



Engine with the Valves Removed and Springs Released.

1—Released Valve.

2—Extended Valve Spring.

3—Valve Spring Collar.

4—Timer Cover Clamp Spring.

ture was made when the last valve spring of the forward four was lifted, and the manner in which the spring was compressed will demonstrate the efficiency of the method.

The Condition of the Valves.

The next illustration shows the valves removed from the guides and ports and with the springs extending from the valve guides to the tappet guides, there being considerable difference in their length when the tension is lessened. The valves were left in the ports to be photographed, so that their condition could be shown. One will observe that the edge of the first valve from the forward end of the cylinder block, which is an exhaust valve, shows a very large and deep pit, and that the edges of the fourth, fifth, seventh and eighth valves all show more or less carbon.

All of the stems are partly coated with carbon, which is worn in places from contact with the guides, and there is more carbon on the first, fourth, fifth and eighth valves, which are those of the exhaust ports, than can be seen on the others. The deposit on the eighth valve indicates the excess of oil that reached the fourth cylinder. Careful observation of the edges of the valves will show that they could not have maintained normal compression, and there is no doubt that efficiency of the engine so far as power development was concerned was considerably reduced.

Statement should be made that when the valves were withdrawn from the guides they were each marked with a file on the heads with from one to eight lines, to indicate the port from which they had been taken, so that they could be

carbon was dry and hard, and it was removed by scraping with a putty knife, the tool being shown standing on the third piston and against the wiring. The complete removal of the carbon can be noted by the practically polished appearance of the clean piston head. The carbon and the shellac was quickly scraped from the cylinder casting.

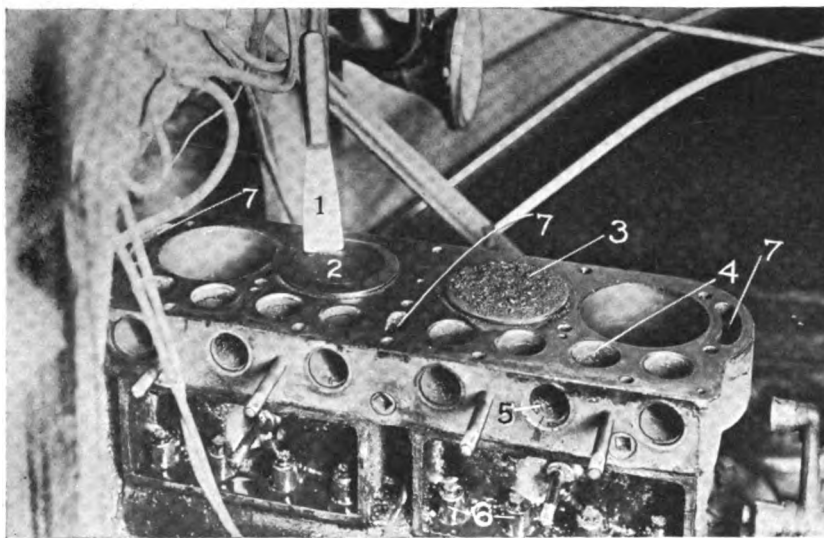
In such work care should be taken to keep the carbon from dropping into the water jacket openings, the valve ports and the screw holes. If the carbon enters the water jacket it may obstruct the circulation, and if it enters the ports it may obstruct the exhaust or the intake of the fuel, while filling the screw holes might possibly prevent the seating of the screws and the complete retention of the cylinder head when it is replaced.

When work of this kind has been done good judgment dictates that the screw holes and the valve ports and manifolds should be blown out with air, under pressure if possible, or with a tire pump, and effort should be made to thoroughly clean them all while there is opportunity to reach them conveniently.

Cleaning the cylinder block head is quite as important. One way of doing this work is to replace the spark plugs in the holes in the casting and placing it bottom up fill it with kerosene. This should be left for 24 hours, at the expiration of which time the deposits ought to be so softened that they may be removed by a vigorous wiping and scraping. Another

practical method is by scraping, either with a putty knife or with a wire brush. In cleaning, the same care should be taken to prevent carbon or other foreign matter getting into the water jacket openings.

(To Be Continued.)



Cylinder Block with Carbon Removed and the Cleaning Tool.

- | | |
|--------------------------------|----------------------------------|
| 1—Putty Knife. | 5—Carbonized Exhaust Port. |
| 2—Cleaned Piston Head. | 6—Valve Tappet Guides. |
| 3—Carbonized Piston Head. | 7—Cylinder Water Jacket Outlets. |
| 4—Carbonized Inlet Valve Port. | |

returned to the same port. The reason for this, while all valves are supposed to be interchangeable, is that they had been ground and fitted to these ports, and there was more probability that they would require less grinding and fitting if they were not changed.

With the Carbon Removed.

The fourth illustration shows the head of the cylinder block after the carbon had been removed from it and from three of the piston heads. Because the first and fourth pistons had been cleaned the engine was turned over and the pistons are not those seen in the previous illustrations. One will note the condition of the second piston head, which was badly carbonized. The

To show the populace of Oklahoma City just how easy it is to steer the Jeffery touring car, W. W. Land, manager of the Oklahoma Motor Sales Company, attached two 10-foot ribbons to opposite sides of the steering wheel, ran them over the front seat and taking his position in the tonneau "drove" the car through the down town streets.

WORLD'S SALESMANSHIP CONGRESS.

The first World's Salesmanship Congress will be held in Detroit during the first week of July, 1916, and every country in the world is expected to be represented. The purpose is to take the first organized step toward bringing the profession of salesmanship to the high standard it is entitled to among business organizations.

At a meeting held at the Detroit Board of Commerce, Dec. 22, D. M. Barrett, editor of Salesmanship, was elected general chairman of the World's Salesmanship Congress. The following automobile men are members of the executive committee:

Hugh Chalmers, president of the Chalmers Motor Company; Harry W. Ford, president of the Saxon Motor Company; Norval A. Hawkins, manager of sales of the Ford Motor Company; W. C. Standish, Detroit, resident manager of the United States Tire Company; H. M. Jewett, president of the Paige-Detroit Motor Company.

L. D. Robertson, manager of the Detroit branch of the Packard Motor Car Company, and Paul Smith, sales manager of the Chalmers Motor Company, are members of the finance committee. L. H. Hills, general sales manager of the Packard Motor Car Company, is a member of the arrangements committee.

On the programme committee are Mr. Chalmers, Mr. Ford, E. LeRoy Pelletier (chairman), advertising specialist of Detroit;

Lee Anderson, commercial manager of the Hupp Motor Car Company; Frank G. Eastman, advertising manager of the Packard Motor Car Company; Julian C. Weed of the Timken-Detroit Axle Company. W. C. Standish of the executive committee is also chairman of the entertainment committee.

NEW CAR SHOWS STERLING QUALITIES.

To test the qualities of the new Sterling-New York roadster, two men recently left New York City for an endurance run to Boston, making the trip in less than 12 hours. Notwithstanding the

heavy going encountered, the car was sent along on high and at no time during the trip was the gear changed. Eleven gallons of gasoline were consumed.

This car is a new comer in the field of low-priced automobiles and is now being shown in the company's new salesrooms at 8 Central Park West, New York City.

DOUBTS MILLION CAR OUTPUT.

Predictions of an output of 1,000,000 cars for 1916 are doubted by H. S. Daniels of the Kissel-Kar company. He does not believe that sufficient



Window Display of the Post & Lester Company, Boston, of Dixon's Automobile Lubricants in a Frame of Dixon's Portraits of Racing Drivers Which Attracted Much Attention in the Hub.

material is available to manufacture that many cars, although a demand for them probably exists. The scarcity of some materials and the soaring cost of others must result either in a shortage of cars or an increase of prices, or both. The 703,000 cars sold last year were sold largely because of sensational price reductions, he believes, and what effect on the volume of business an increase in price would have is still to be determined.

In his opinion it is an excellent year to order a new car early if one expects delivery and does not wish to have to buy a car of a make that is not desired at an advance in price.

CORRESPONDENCE WITH THE READERS.

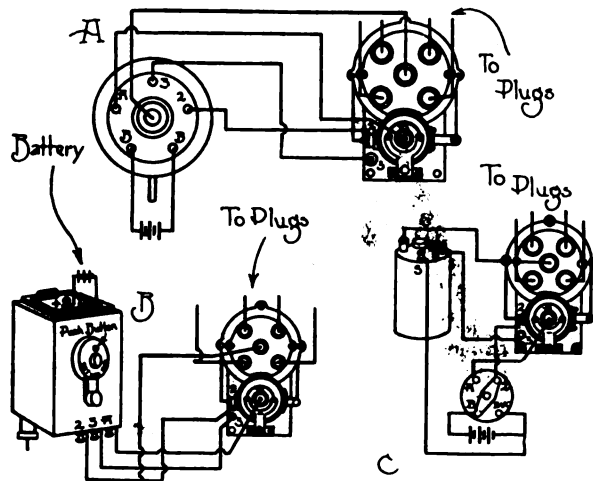
A Clearing House of Practical Information—Solutions to Vexatious Problems Relating to Motor Vehicles—This Service Is Free to All Subscribers.

Adjusting Carburetor—H. V., Beloit, Wis.

Will you please explain in your next issue how to adjust a model L Schebler carburetor, also how to wire a model D Splitdorf high-tension dual magneto?

Before adjusting the carburetor determine that there is a hot spark at each spark plug, that the valves are properly timed and seated and that all connections are tight. The instrument should be adjusted when the engine is at normal running temperature.

The first operation is to set the auxiliary air valve so that the valve seats lightly but firmly. Close the needle valve by turning the adjustment screw to the right until it stops. When the re-



Wiring Diagrams for Splitdorf Models A, B, D, F, O and T Magnetos—A, Splitdorf Magneto and T S Transformer; B, Splitdorf Magneto and Dash Transformer; C, Splitdorf Magneto and Tube Transformer.

sistance is encountered do not exert additional pressure. Next turn the screw to the left about four turns and prime the carburetor. Open the throttle lightly and start the motor. Then retard the spark and throttle levers and adjust the throttle lever screw and the needle valve adjusting screw so that the motor operates at the desired speed and fires on all cylinders. This is the low speed adjustment.

After obtaining a good adjustment with the motor running idle do not touch the needle valve adjustment again. The intermediate and high speed adjustments are made on the dials. Adjust

the pointer on the first dial about half way between 1 and 3. Advance the spark and open the throttle so that the roller running on the track below the dials is in line with the first dial. With the spark advanced, if the motor back fires with the throttle in this position, turn the indicator a little more towards figure 3. If the mixture is too rich the indicator should be turned in the opposite direction. This is the intermediate speed adjustment.

Now open the throttle wide and make the adjustment on the second dial for high speed in the same manner as the adjustment was made on the first dial for intermediate speed.

The Splitdorf instruction book lists the model D only as a low-tension type. As you do not state the type of transformer used, the accompanying wiring diagrams are for both the dash and tube transformers.

Use of Alcohol—W. E. C., Tarrytown, N. Y.

Is it good practise to inject a little denatured alcohol in the head of the cylinder to remove carbon?

If the cylinders are heavily carbonized it is safe to state that the only manner in which the carbon can be removed is to scrape or burn it out. Further formation of carbon can be prevented by injecting a little alcohol in each cylinder at regular intervals, when the temperature of the engine is at a high point. The alcohol then readily vaporizes and penetrates any small formation of carbon that may be lodged there. The tendency is to loosen the deposit so that it will be ejected with the exhaust gases. No injury will result from the use of the alcohol in this way.

Clutch Brake—R. H. S., Willow, Cal.

I recently had a clutch brake attached to my truck and it greatly assists gear changing. I am told that when coasting down grades I should disengage the gear and leave the clutch engaged. What would be the effect if the gear should be left engaged and the clutch released?

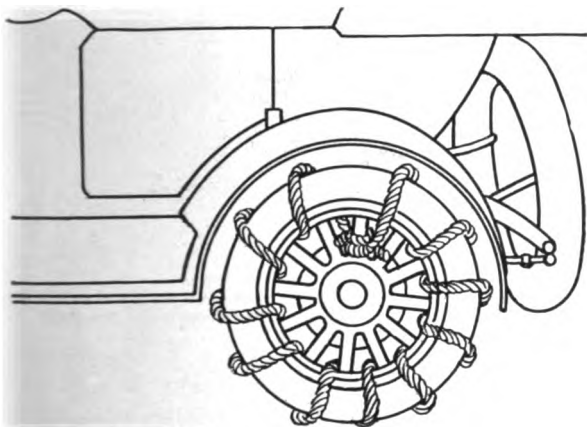
You have been properly advised. If the gear was left engaged and the clutch released, there would be rapid wear on the clutch brake. When the gears are meshed in the transmission, the female member of the clutch is in direct communication with the main shaft. When coasting, this

shaft is controlled by the rear wheels. The rotary motion is transmitted through the axle shafts to the differential and from there to the drive shaft, which is nothing more or less than an extension of the main shaft. By disengaging the gears the main shaft in the transmission has no connection with the female member of the clutch and it can be easily stopped by the brake if desired by depressing the clutch pedal.

Regaining Traction—S. F., Wyoming, Ill.

What would you suggest to regain traction in an emergency, as when one wheel is spinning on a slippery surface and the tire chains are not at hand? My car is of the heavy touring type and is equipped with 36-inch tires on the rear.

A method which would be effective under certain conditions may not be practical under others. Frequently traction can be regained by placing small pieces of wood, burlap, etc., on the road's surface and driving the car very slowly. If a length of rope is handy, the simple, yet effective



Simple and Practical Way by Which to Regain Traction.

means of getting started, as shown in the accompanying illustration, can be employed. One end of the rope is tied to a spoke in the wheel, and the rope wound round the tire as shown. It should be remembered that the slower the car is operated, the greater will be the gripping power of the wheels on the slippery surface.

Repairing Old Casings—E. J. P., Newcomerstown, O.

I have a set of Flisk tires that have made over the guaranteed mileage. The fabric is still good, but the tread is badly worn. What would it be advisable to do so that the service of these casings can be extended? Would it pay to have them retreaded? Some use old worn out casings, after cutting away the bead, over the good casings and claim it extends their service several thousand miles. In using old casings for tread, how much larger should they be than the casings they are to cover?

Would advise that you have the casings examined by a tire expert. He will be able to de-

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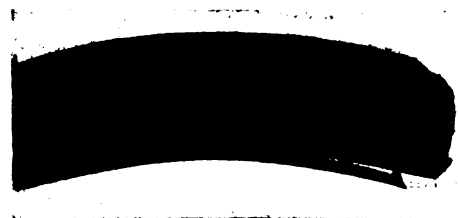
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termine the strength of the canvas and the repair that should be made. I would not advise the placing of a much worn casing over a good one, as the service given would not warrant the work. It would be much the better practise to place the much worn casing inside of the good casing. This repair is now being done by tire repairers and is giving general satisfaction. Two casings of the same size are selected, one having a good tread and the other a much worn tread, but good fabric. The casing having the good tread should be used for the outer casing and the other for the inside casing. The first step is to trim the bead from the outer casing. Next make a cut through the rubber of the inner casing about $\frac{1}{4}$ inch from the joint of the tread on each side. This cut should extend through the rubber to the canvas fabric and the rubber between the cuts should be peeled off. After cleaning the inside of the outer casing thoroughly with gasoline it should be smeared well with vulcanizing cement. Now insert the inner casing and fit the two as smoothly



Instance of Repair of Old Casing. Two Casings Being Sewed Together by Singer Tire Sewing Machine.

as possible. When the two are properly fitted there should be a space of at least $\frac{1}{4}$ inch from the bead of the inner casing to the edge of the outer casing. The tires are then placed on a machine and stitched together. The accompanying illustration shows a remade tire.

Definition of Lapping—W. W. S., Meriden, Conn.

I recently read in a technical book about "lapping" pistons and cylinders. What is meant?

By the word lapping, as applied to automobile mechanics, is meant the process of working in motor parts, such as pistons and cylinders. The pistons are lapped in by running the motor by a belt and feeding ground glass mixed with a light oil into the cylinders through a plug opening.

Driving Saw Mill by Motor—J. B. B., Baltic, Conn.

I have seen pictures of a saw mill and other farm machinery being run by an automobile engine, a pulley usually being on the engine shaft where the crank was first. It seems to me that this would hurt the motor. What do you think?

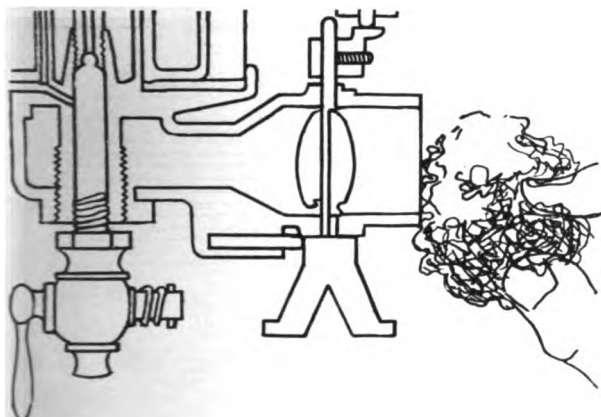
It is not advisable to use an automobile motor

tor for such purposes in the way you mention. Of course it is entirely feasible and in emergencies can be done without much harm resulting. However, the pull of the belt running on the pulley on the motor shaft produces strains on the whole motor for which it has not been built. Such strains are likely to wear the bearings and throw the shaft out of alignment if long continued. To use a motor for such work would be false economy; it would be cheaper in the long run to buy an engine that was built for the purpose.

Starting the Cold Motor—J. J. M., Battle Creek, Mich.

I have an early model two-cylinder car which is equipped with a Schebler carburetor. On cold mornings I experience much difficulty in starting the motor. Priming the instrument does not give much assistance. To inject gasoline into the cylinders requires the removing of the spark plugs. When raw gasoline is placed in the cylinders the engine will usually start, but it stops when this fuel has been consumed. My friends advise the use of ether. Will this fluid have any injurious effect on the motor and how will I use it?

Ether is a much more volatile liquid than gasoline and if correctly used should have no injuri-



How Waste Soaked with Ether Should Be Held Near Air Intake of Carburetor to Facilitate Starting a Cold Motor.

ous effect upon the motor. The method advised is shown in the accompanying illustration. If desired the motor can be started by injecting a little gasoline into each cylinder. A piece of waste is saturated with the ether and when the motor starts it should be held quite near the air intake of the carburetor. Priming the carburetor slightly will also assist the operation. The reason for difficulty of starting on cold mornings is that the car mentioned has no provision for heating the air drawn into the carburetor or the jackets of the intake manifold. heated articles, such as hot cloths, hot sand bags, etc., applied to the intake manifold will greatly assist in carrying the mixture of fuel and air into the combustion chambers of the cylinders.

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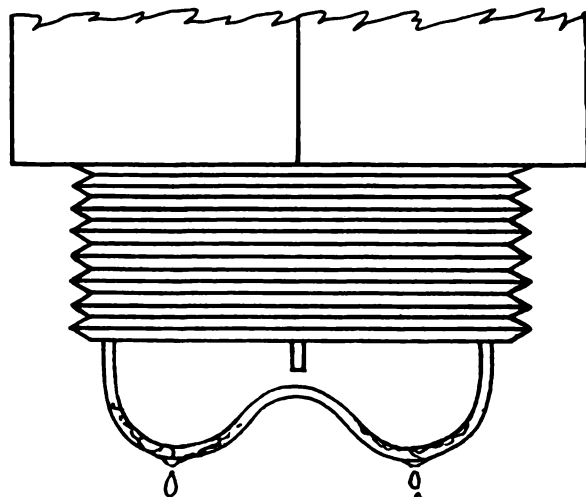
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A Skipping Cylinder—T. L. M., Webster, Mass.

I have a Ford touring car which has been run about 8000 miles. Recently the No. 1 cylinder has given much trouble. At times it will misfire and fire unevenly for five or 10 minutes and then pick up and run smoothly. By cleaning or replacing the plug, the trouble is temporarily eliminated, but returns after running about 10 miles. Regardless of the make of plug the trouble is the same. I have installed new wiring and all contacts are tight. Can you suggest what the trouble may be?

It would appear that as the trouble can temporarily be overcome by changing or cleaning the spark plug, the source of trouble is not to be found in the ignition. As the plug dirties readily, it is almost conclusive evidence that an over abundance of oil is reaching the combustion chamber and accumulating on the plug. A remedy worth trying is to fit piston rings that have sealed openings. Frequently an over abundance of oil is splashed into the front cylinder by the settling of the front spring, thus causing the greatest amount of oil to flow to the front of the crank



Shell Electrode of Spark Plug Bent Into an Arch to Prevent Oil from Accumulating on Sparking Point.

case. In that case the spring should be replaced or the front of the car shimmed at the point bearing on the spring. Another simple remedy is to bend the shell electrode of the plug in an arch shape, as shown in the accompanying illustration. Any machinist can make a shell electrode of this type. The advantage of the arch is that the oil contacting with the electrode will flow away from the arch, which keeps the sparking points clear.

Pedal Sticks—E. G., Stamford, Conn.

What adjustment should I make to prevent the pedal of my model T Ford from sticking in the forward position? Why should No. 1 plug foul very quickly when going down hill?

At the bottom of the pedal shaft will be four

an adjusting screw by which the forward travel

of the pedal can be limited and the sticking overcome.

The first plug fouls easily when running the car down hill because the oil level in the splash pan is changed by the inclination of the car so as to allow too much oil to be dipped up into the first cylinder, where it carbonizes.

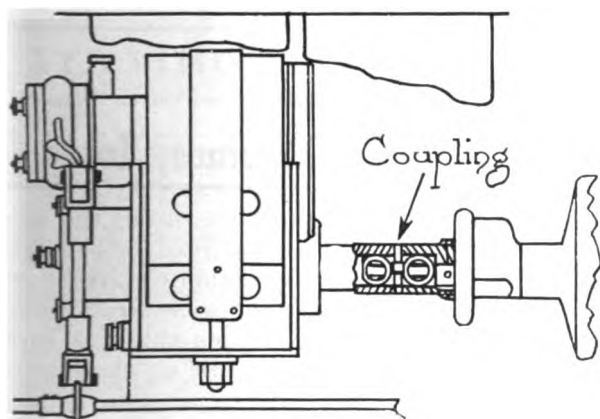
Cleaning Plugs—E. N. H., Auburn, R. I.

How can I clean spark plugs without going to the trouble of scraping them?

An effective method is to boil them in lye. This will remove all oil and carbon in the majority of cases. Be certain though that they are thoroughly dry before being used again.

Irregular Operation—W. H., Seltuate, R. I.

I have a four-cylinder — touring car which has given satisfactory service for about 1½ years. Recently the operation has been irregular when operating on the magneto and also when operating on the battery. I also notice a knock which sounds somewhat like that pro-



Illustrating How Coupling Is Usually Secured to the Magneto Shaft.

duced by a loose tappet. I have adjusted all tappets, however, had the magneto and carburetor overhauled by a reliable repair man and installed a new coil. Compression is good on all cylinders, the valves properly timed and am using — spark plugs in each cylinder. There is no short circuit in the ignition cables and all connections are tight. It is not a regular miss and occurs mostly when the speed of the motor is reduced.

From information given, the trouble appears to be of an uncommon nature. It is advisable to examine the connection which drives the magneto. It may be that the coupling on the magneto shaft has worked loose or that the key is loose. This condition would cause irregular timing, knocking and irregular motor operation. The coupling is usually secured to the magneto shaft by a nut. If the key is loose, it should be replaced by a tight fitting one and the nut securely tightened. The accompanying illustration shows a coupling commonly used for magnetos.

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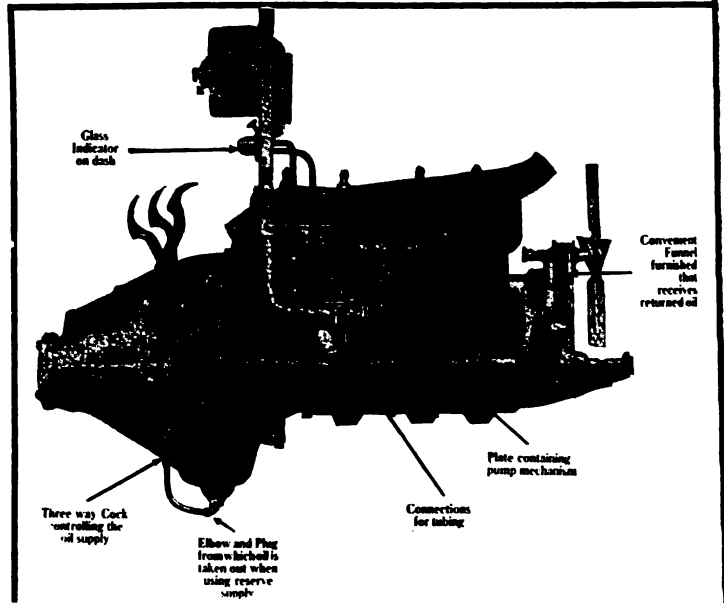
gives the driver at all times a convenient check on the flow of oil. This eliminates the inconvenience of turning bottom pet cock to ascertain oil supply.

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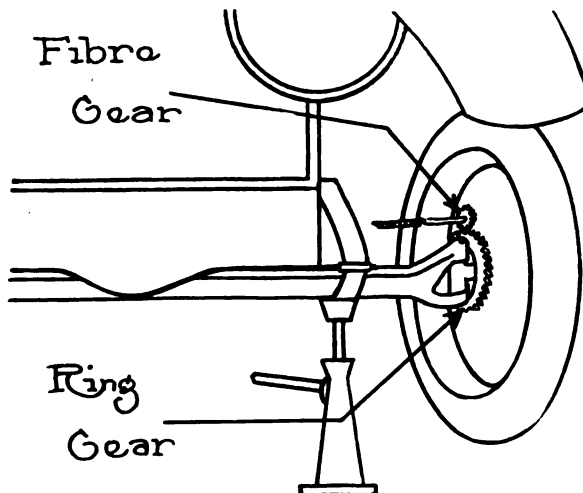
PRICE COMPLETE

The best spent "five" you will ever spend

Cooling System—I. M. T., Hagerstown, Md.

I have been told that a solution of soda and water is good for cleaning out the cooling system. What proportion of soda and water should be used, and how should the solution be put in the system?

A great many motorists and mechanics advo-



How Speedometer Fiber Gear Meshes with the Ring Gear.

cate the use of the soda and water solution for the purpose you mention. A half pound of soda should be thoroughly dissolved in five gallons of water and carefully strained. Before pouring it

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into the radiator and cooling line, drain the system thoroughly. With the mixture in the system run the motor for a few minutes and then drain. Next flush the system with clear water and again run the motor. When this has been drained out, the system should be as clean as is possible with such a mixture.

Speedometer Gear Adjustment—N. H. L., Doylestown, Penn.

I hear a loud swishing sound at each revolution of the right forward wheel of my car. I have injected lubricant into the speedometer cable case and the gears do not appear to be deeply meshed. Any advice on the subject will be appreciated.

If the wheel is equipped with a demountable rim it may be that the retaining bolts need tightening or replacing. The writer, however, is of the opinion that the trouble can be located in the speedometer gears. It is a difficult operation to attach the wheel ring gear so that it will rotate absolutely true. The result is that there is a high and low spot on the gear. The correct adjustment of the ring and fiber gears can therefore only be obtained by jacking the wheel, as shown in the accompanying illustration, and rotating the wheel until the highest point is ascertained. This is the point where the two gears should be correctly meshed.

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IT MEANS VALUE—the utmost in efficiency per dollar of cost just to the extent that a car is standardized does the buyer's dollar approach the maximum of purchasing power.

Standardization means definite, proved quality, known manufacturing costs and reduced selling costs.

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Rayntite Fabrikoid top material, single or double texture, is guaranteed one year against leaking, but built to last the life of the car.

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Harsh Gripping Clutch—T. K. G., Newark, N. J.

My car is a ——— roadster and is equipped with a leather cone type clutch. I recently had the clutch re-lined and although I have used much neatsfoot oil, there is a fierce gripping action each time the clutch is engaged. The spring tension does not seem to be too strong. What do you think is the matter with it?

It would appear that the leather on the male member of the clutch does not engage for its full width with the female member of the clutch. If the high spots cannot be determined by the general appearance of the leather, the method shown in the accompanying illustration can be used for the test. Depress the clutch pedal and then insert a piece of white paper between the flywheel and the leather faced portion of the clutch. Engage the clutch and then depress the pedal again. When the paper is removed the high spots will be plainly indicated on it. The leather should then be trimmed to the surface uniform in height.

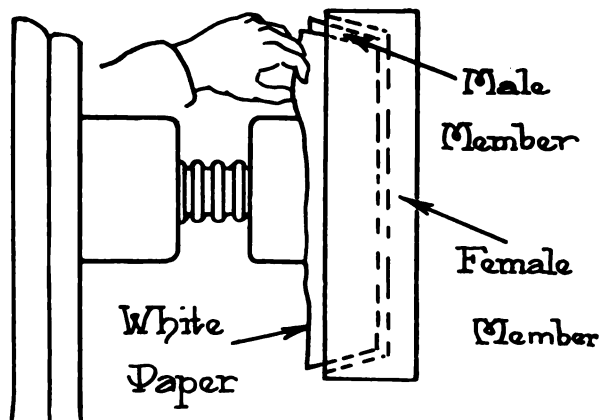
Ignition Systems—H. R., Homewood, Kan.

Kindly explain fully in The Automobile Journal the "dual" and "double" ignition systems; also, just what is meant by "generator-battery."

A dual ignition system is, in general acceptance of the term, that which has two separate sources of current, a magneto, either with or without a transformer coil, and in addition a battery and coil. Usually the circuit breaker, the

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distributor and switch, the high-tension wiring and the spark plugs are used for both systems, but in some systems there are separate circuit breakers for both the magneto and the battery currents. In this neither system is wholly independent of the other.




Determining the High Points of a Harsh Gripping Clutch.

A double ignition system is that with separate sources of current, the one being a high-tension magneto either with or without a transformer coil, with complete wiring and spark plugs for this system, and the other having a battery,

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can be bought at the same price? They overcome all Engine troubles, fire where others fail and Add Power to engine. Any length point desired made to order. Try them and you will use them—always. Make a trial and save money. \$1.00 each, 6 for \$5.00.

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Mea
MAGNETOS



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(When Writing to Advertisers, Please Mention The Automobile Journal.)

transformer, coil, timer or distributor with complete wiring to a second set of spark plugs. Either of these two sources of current and systems of wiring may be used independently of the other. One system could be disconnected or removed, and the engine could be operated efficiently with that remaining.

The term "generator-battery" has evidently been applied to what is known as a primary cell, of which the familiar dry cell is one type, generally consisting of two or more plates of dissimilar metals suspended in a bath of alkaline or acid solution. The action of the bath upon the metals will create a flow of electricity from the plate or plates which are most susceptible to attack or decomposition to the plate or plates that are least susceptible, when these are connected by a circuit of wire. The life of such cells is measured by the volume of the metals and the solution or electrolyte. The dry cell is designed to practically consume the metal before its usefulness is ended; the wet cell can be restored by renewing the electrolyte and the electrodes.

Delco System—W. H. A., Springfield, Mass.

Describe the third brush method of control of the 1916 Delco starting and lighting system, and the advantage it has compared with the 1915 Delco "coil" control.

The 1915 Delco systems have three different methods of control, that most generally used regulating the amperage by a centrifugally operated governor and resistance; the second using a reversed series dynamo winding, and third a regulator operated by a vibrator that inserts resistance in the shunt field, this regulator being mounted on top of the motor generator.

The third brush design has a third brush mounted above the two generator brushes that is offset toward the right brush when looking at the commutator end of the machine. One end of the shunt field winding is attached to this brush, while the other end of the shunt field winding leads to and is attached to the generator brush that is farthest removed from the centre or third brush. The position of this centre or third brush will govern the production of current.

The third brush is usually set to cause the current output to decrease as the speed of the generator armature increases. The charging rate of the generator is increased when the third brush is moved nearer to the main brush closes to it, and the charging rate is decreased as the third brush is moved toward the central point between the two main brushes.

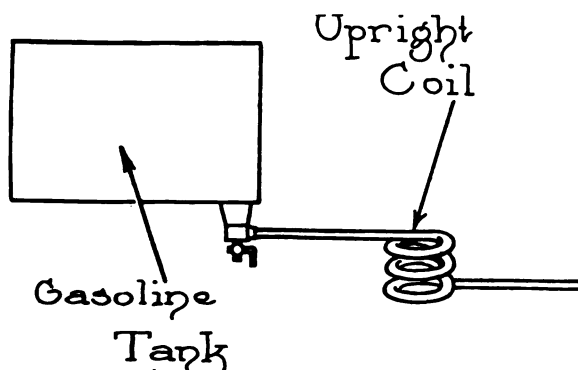
The use of the third brush is to obtain high charging rates at vehicle speeds between 12 and

25 miles an hour. Those who drive faster require less current for lighting and starting as they make fewer stops—that is, the ratio of stops to mileage is smaller than of the other class. Those who drive slower—whose average driving speed is between 12 and 25 miles an hour, experience greater difficulty in keeping the battery charged; those who drive faster usually find the batteries charged satisfactorily. Generally speaking, the third brush method of regulation is best suited for those who drive their cars slowly.

Clogged Gasoline Line—D. P. B., Orange, N. J.

Can you suggest a way in which I can overcome clogging of the gasoline line on my motor? There is now a horizontal coil in it, which I understand prevents vibration. This chokes up very frequently.

This trouble is common when a horizontal coil is employed. While it is true that this type will prevent vibration, it has the great disadvantage of allowing sediment to lodge in the lowest parts of the coils and consequently to impede the flow



Illustrating Construction of Upright Coil for Gasoline Line.

of the fuel. This can be overcome by having an upright coil installed, one similar to that shown in the accompanying sketch. This type will prevent vibration and also will not allow sediment to clog the passage.

Storage Battery—J. M., Northampton, Mass.

There has been a great deal said recently about taking care of the storage battery during the winter. What is your opinion of the best method?

Unquestionably the best method for a car owner who has the ordinary facilities is to place the battery in the care of a garage man, who will, if instructed, charge it every month, or even oftener, and give it the same attention it would receive were it in use on the car.

If you desire to take the responsibility upon yourself, what will be required of you is that the battery be charged at least once every four weeks from the generator of the car. And the battery

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BOULEVARD ROADSTER
\$855**

Four Cylinder Motor, $3\frac{1}{4} \times 5$, en bloc
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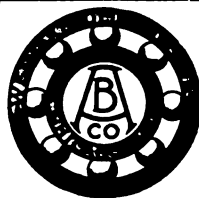
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THE STANDARD OIL
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When Gasoline is High— Look to Your Lubricants!

The average car owner would save ten per cent. on his gasoline bills, if he could coax another mile or two out of each gallon.

Friction is the Greatest Foe of Fuel Economy

It eats up power in bearings and gears; it eats up bearings and gears, too. Efficient lubrication will do much to offset the depredations of friction.

Tests made by leading auto manufacturers have proved NON-FLUID OIL to be the highest grade and most efficient automobile lubricant produced.

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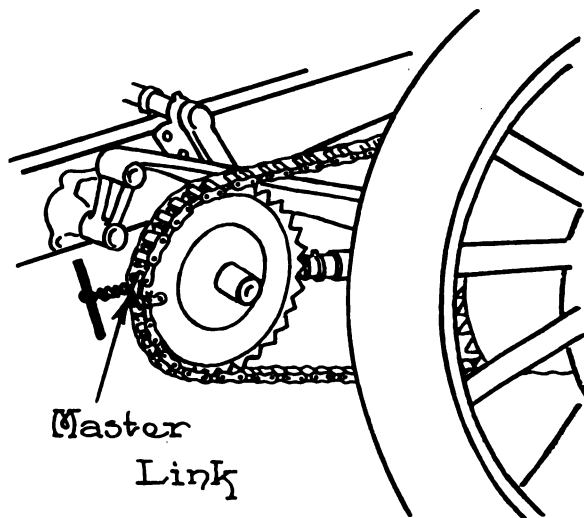
must not be kept in the cold garage or other place; it should be kept in the house where the temperature is normal. It may be that your car has no generator, in which case it will be necessary to have the charging done by the garage man.

Replacing Driving Chains—P. J. H., Newark, N. J.

I have a great deal of trouble when replacing the driving chains of my truck. It is very difficult and requires a lot of strength to get the master link in place. How can I do this more easily?

A simple method is shown in the accompanying illustration. First place the chain around the wheel sprocket and bring the two ends together on the sprocket attached to the end of the jack-shaft.

If the chain cannot be drawn tight enough so that the master link can be inserted easily, loop a piece of annealed wire through the end links of



Easy Method of Remounting Truck Drive Chain.

the chain and wind it up on a stout stick or metal bar, in the fashion of a tourniquet.

When replacing the master link it is advisable to place the detachable plate on the outside so that the retaining cotter pins will be accessible for inspection or removal.

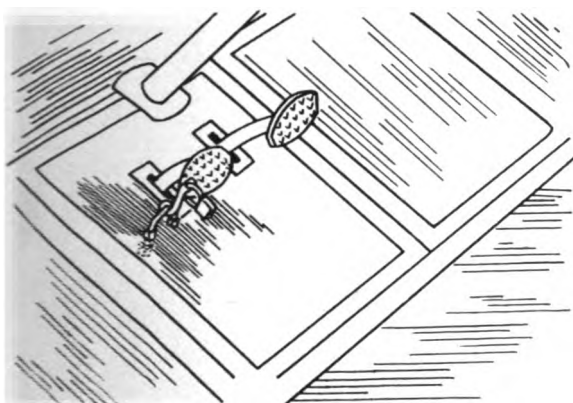
CARE OF BREAKER POINTS.

The platinum tips on the breaker bar and adjusting screw of the magneto may become pitted after considerable service. This will cause uneven ignition and can be remedied by smoothing the points with a fine jeweller's file. Take care not to remove too much of the metal. When resetting the adjusting screw it is well to follow the maker's instructions as to the distance of

break. Some manufacturers advise a break of $1/64$ inches, while others suggest $1/32$. If it is necessary to replace the points, only the best material should be used. It is safe to state that under normal conditions the only care the magneto will require is an occasional cleaning and adjusting of the contact points and lubricating of the bearings. It may be well to apply a little oil to the roller on the breaker bar at regular intervals. This can best be done by dipping a toothpick in the lubricant and then applying to the part. The above is practically all the care that the instrument should require, and if the driver is not fully conversant with the mechanism, he should not try to improve its operation by tampering.

HOME-MADE PEDAL LOCK.

The simple lock illustrated herewith is designed to prevent unauthorized persons from



A Simple Home-Made Lock for Pedals.

operating the car's clutch. It consists of a half-inch steel rod that is threaded on both ends and bent at right angle. A steel hook, having a small hole at the end, is then placed on the threaded piece of steel, after which the assembly should be hardened.

Screws are turned on the bent rod and then the threaded ends inserted in holes drilled in the floor board. Nuts hold the assembly to the floor; the threaded ends can be riveted over. The hook should be placed in such a position that when the clutch pedal is depressed the hook can be lifted over it. If a small hole is drilled in the surface of the pedal to correspond with the hole in the hook, a strong padlock can be used for locking.

Pads of felt or leather placed between those parts of the body and frame that contact will stop the squeaking sounds.

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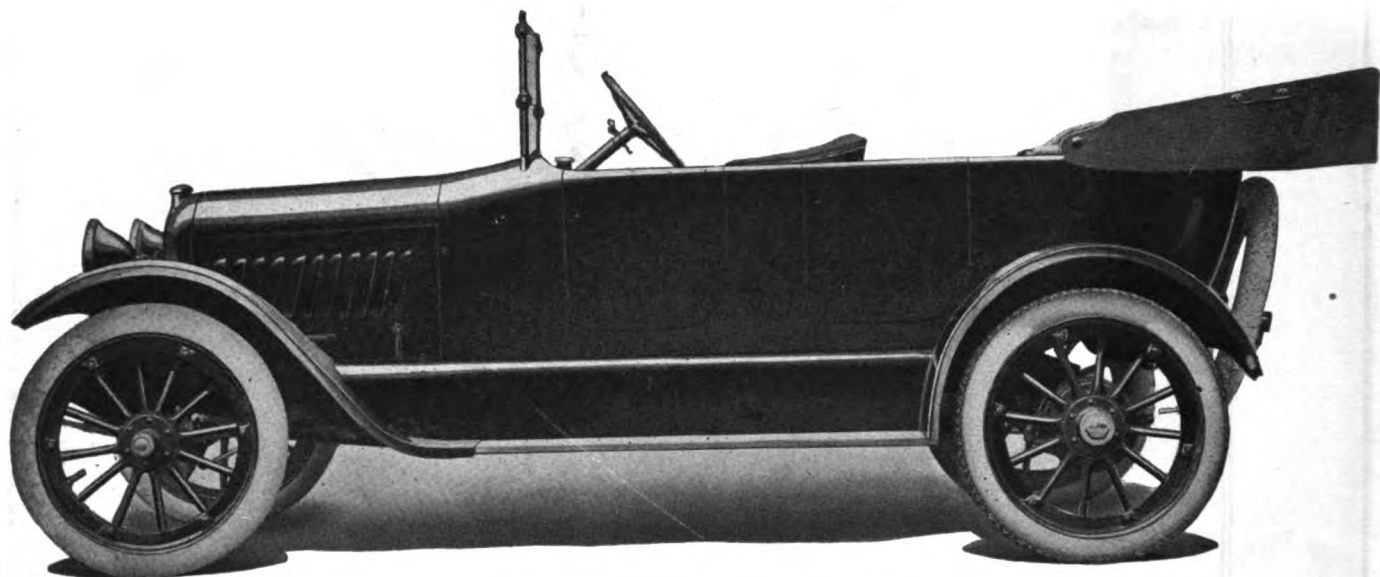
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For just as your eye tells you the Grant Six is a beautiful car, so your ear tells you it has a wonderfully quiet, smooth operating motor, carefully cut gears, fine bearings. Your sense of feeling tells you that the car is well put up. It is "knit" together to stay.

The feel of the wheel, the instant and

eager response of the motor, the throttling down to $1\frac{1}{2}$ miles an hour on high gear or speeding up to 55 miles within a short distance tell you of power properly applied, aided and developed by the best that is known in ignition, carburetion and construction.

20 miles—and up to 30 miles—per gallon of gasoline, and 900 miles to the gallon of oil. Those are Grant Six records. And the Grant Six can't be beaten on high gear hill work for it couples power in excess with light weight.

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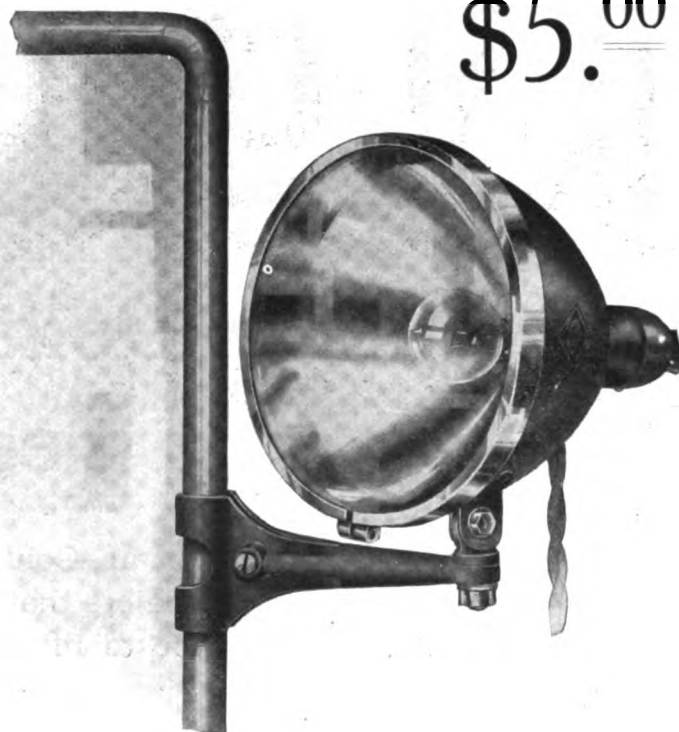
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Electric starting and lighting; $3\frac{1}{4} \times 5\frac{1}{2}$ motor; four full elliptic springs; 104-inch wheelbase; beautiful Briscoe-line body; full equipment, including one-man top, speedometer, electric horn and demountable rims.

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The more prospective buyers you as a dealer can interest in your line, the greater will be your sales and your profits.

Eight out of every ten motorists in your territory will find in one of the Briscoe models the ideal car for their use.

The Briscoe Twenty-Four unquestionably dominates the popular-service field today. No other car offers so much in beauty, in comfort, in service or in value.

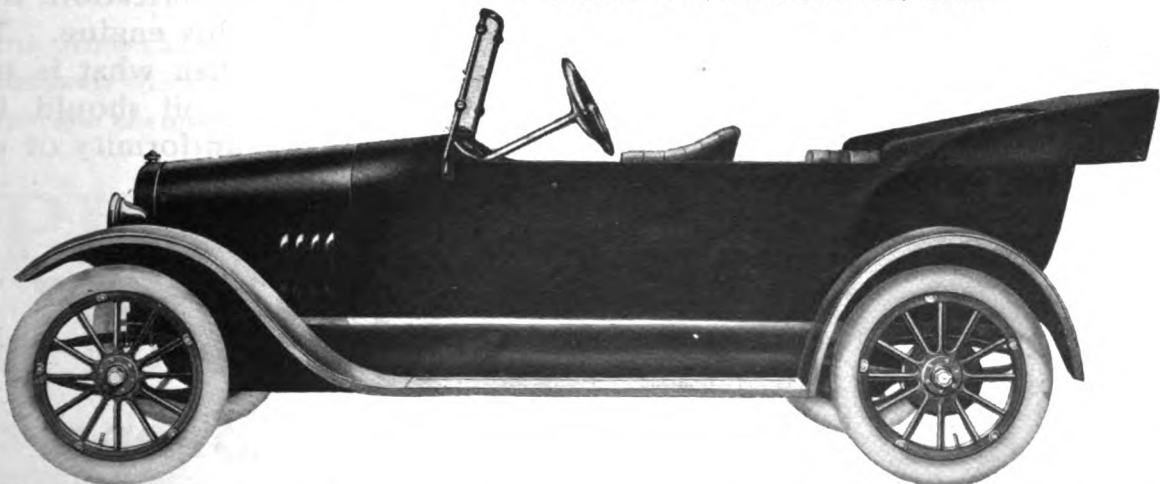
The Briscoe De Luxe Four 38 at \$750; and the Eight 38 at \$950, are remarkable examples of what engineering skill and manufacturing efficiency can do in lowering the price of a de luxe car.

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There are scores of prospective Briscoe buyers immediately around you. Write or wire regarding your territory---or come in to the factory if you can.

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The new car goes through what may be termed a development period which is the first thousand miles it is driven, during which all of the moving parts reach the relation to each other intended by the designer, and friction is reduced to a minimum by the wear if perfectly lubricated.

During this period the car, and especially the engine, becomes "limbered" and reaches its highest degree of efficiency. Motorists who, from lack of experience and mechanical knowledge, use oils of unsuitable viscosities generally damage an engine, that is, instead of obtaining higher efficiency, the engine wears, resulting in loss of power and hastening repair expense.

The owner who knows the results from poor lubrication, not only buys the best quality oils, but the grade that is best for his engine. The oil used until the engine is "limbered" should be lighter than what is used when it is at its height of efficiency, and the grades of oil should be gradually heavier as the engine wears, this insuring greater uniformity of compression and maximum power.

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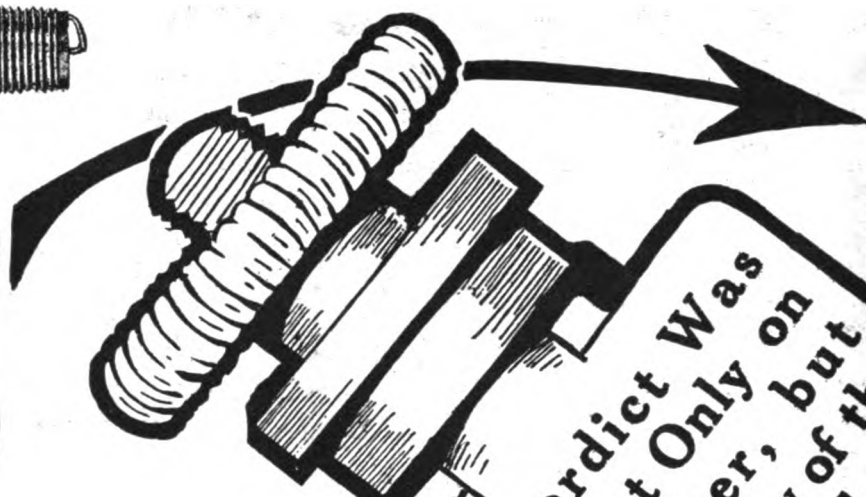
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The Verdict Was
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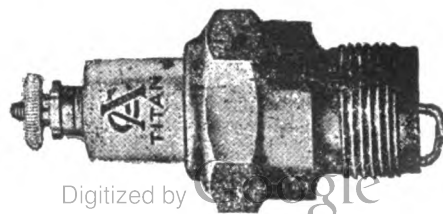
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Champion Plugs - 17	Rajah Plugs - - - 3	Valco Plugs - - - 1
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Splitdorf Plugs - - 5	J. D. Plugs - - - - 1	Elgin Plugs - - - - 1

There Can Be But One Reason:

They Are the Most Efficient Plugs to Be Had

CHAMPION IGNITION CO.

FLINT, MICH.





Double-Header Power With Pullman Comfort

This new 12-Cylinder National has proven so successful because:

- It is a National.
- It has 12 Cylinders.
- It is America's best looking car.
- It is easy riding.
- It is the smoothest performer.
- And it is *good* in every feature.

You really drive two mighty engines, merged perfectly into one unit, and controlled with childlike simplicity.

Flowing power of utmost flexibility, minimized gear shifting and smoother riding are but samples of its sum totaled

super-eminence. Longer life and resultant economy is one indirect advantage, because that car-wrecker, vibration, is eliminated.

Don't deny yourself the very newest in motoring style efficiency, comfort and pleasure, when National provides all this at a price that revolutionizes the industry.

This Twelve's competitors are the National Six Cylinder cars.

"Highway" Six, \$1690; "Highway" Twelve, \$1990; "Newport" Six, \$2375.

Ask any National dealer or write direct for details of "Six" and "Twelve."

National Motor Vehicle Company

Indianapolis, Indiana, U. S. A.

Boston, Mass., A. T. Hart Co.
Springfield, Mass., Dimm-Semmons Co.
Worcester, Mass., W. C. Wiggin.
Providence, R. I., Knight Automobile Co.
Nashua, N. H., Pollard Auto Co.

Conway, N. H., Brown & Gerry.
Brattleboro, Vt., Manley Bros.
Burlington, Vt., Clifton C. Daigle.
St. Johnsbury, Vt., P. B. Hartwell.
Portland, Maine, Maine Motor Car Co.
Augusta, Maine, W. J. Skehan.

Bangor, Maine, R. M. Flagg.
Lewiston, Maine, F. E. Langley.
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Hartford, Conn., F. A. Law Machine Co.
Stamford, Conn., National Sales Co.

Winter holds no terrors for Ford owners if they use a **SPLITDORF APELCO**

ELECTRIC STARTING AND LIGHTING SYSTEM



\$6

\$73.99 F.O.B. PACIFIC COAST
\$85.99 F.O.B. TORONTO

**EASY STARTING
ELECTRIC LIGHTS**

ALL THE TIME

SPLITDORF ELECTRICAL COMPANY

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DALLAS . . . 402 S. Ervay St.
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KANSAS CITY . . . 1827 Grand Ave.
LOS ANGELES . . . 1215 S. Hope St.

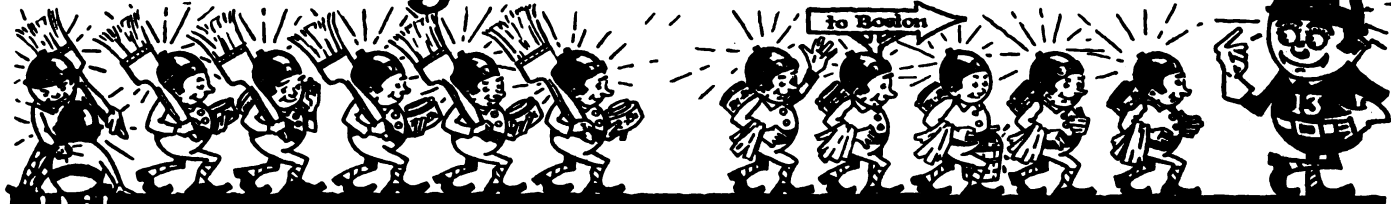
MINNEAPOLIS . . . 34 S. 8th St.
NEWARK . . . 278-80 Halsey St.
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Factories: NEWARK, NEW JERSEY

(All SPLITDORF features are fully covered by patent or patents pending)

Mr. Shine and his 12 Little Shine-Ups will welcome you at the Boston Auto Show.



CAR APPEARANCE

Is a large factor with every owner, and a fine appearing car reflects a motorist's characteristics. A well kept car can always be cared for with a minimum of labor and expense.

THE Be-Be-Co's 12 AUTO SHINERS

Body Polish
 Brass Polish
 Nickel Polish
 Hand Cleaner
 Top Lining Dye
 Motor Car Soap
 Cushion Dressing
 Mohair Top Dressing
 Leather Top Dressing
 Metal and Body Finish (Gloss and Dull)
 Tire Paint (Red, White, Gray)
 Seat and Slip Cover Cleaner

There's a Be-Be Specialty for every need, all proven by every form of service, that are guaranteed to be the most economical, most enduring and most satisfying materials for cleaning, restoring and preserving the finish of an automobile ever made.

Be-Be Specialties are economical because so small a quantity is required, and they are satisfying because of the quality of finish that is obtained. All polishes, dyes and dressings produce finishes that will resist the weather, dust, handling and general wear.

They are sold by all good dealers, in sealed trade marked containers. If your dealer cannot supply your demand we will fill your order direct.

Be-Be Co's Specialties will be demonstrated at the Boston Show, Space 548.

Manufactured exclusively by the Specialty Department of the



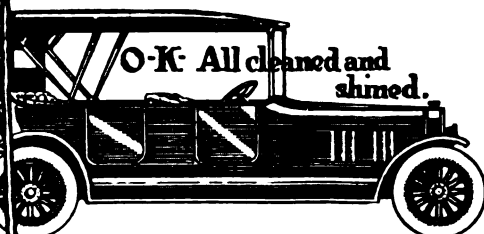
Boston Blacking Co.

Home Office
and Factory

East Cambridge, Mass.

Established 1890

Incorporated 1900



BRANCH FACTORIES: Chelsea, Mass. Montreal, Canada England
Germany France Austria Sweden Italy Australia

BRANCH OFFICES AND WAREHOUSES IN ALL LARGE CITIES

(When Writing to Advertisers, Please Mention The Automobile Journal.)

MOTOR PARTS SERVICE



Motor Parts service is a distinctive organization with a reputation that has been built up exclusively around that factor for which it was originally planned namely—SERVICE.

We bring the facilities of factories right to your door by combining expert engineering knowledge of producers and practical selling and service knowledge of distributors.

We represent the foremost manufacturers of electrical and special equipment for motor cars and motor boats.



As distributors of the following products we carry on hand the same complete stock as will be found in the factories stock rooms:—

Bosch Starting, Lighting and Ignition.	Zenith Carburetors.
Bosch Ford Attachment.	Zenith Ford Equipment.
Bosch Magneto Company, New York.	Zenith Carburetor Company, Detroit.
Westinghouse Ford Starting and Lighting Equipment.	
Westinghouse Electric Company, Pittsburgh, Pa.	
Mosler Spit Fire Spark Plug.	Leakproof Piston Rings.
A. R. Mosler Company, New York City.	McQuay-Norris Mfg. Company, St. Louis.

MOTOR PARTS COMPANY, 818 N. Broad Street, PHILADELPHIA

BOSTON
187 Columbia Ave.

SPRINGFIELD
143 Chestnut St.

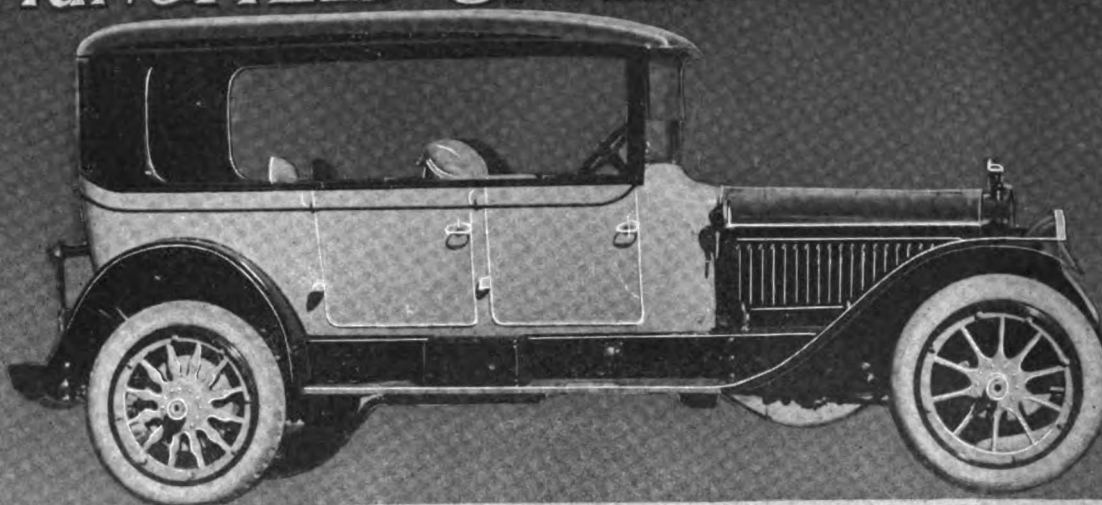
PHILADELPHIA
818 N. Broad St.

BUFFALO
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Service Stations:

American Ball Co., 115 Clifford St., Providence, R. I.	Ellsworth Foundry and Machine Co., Bar Harbor, Me.	Maine Motor Car Co., Free and South Sts., Portland, Me.	Pollard Auto Co., 232 Main St., Nashua, N. H.
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Bangor Motor Co., Bangor, Me.	Gloucester Garage, Gloucester, Mass.	Newport Engineering Works, 359 Thames St., Newport, R. I.	W. J. Skehan, Augusta, Me.
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Ellsworth Foundry and Machine Co., Ellsworth, Me.	William Law Co., 100 Dartmouth St., New Bedford, Mass.	Portsmouth Motor Mart, Portsmouth, N. H.	C. E. Whitten, 40 Central Ave., Lynn, Mass.

SPRINGFIELD CONVERTIBLE BODIES



ONE BODY FOR EVERY SERVICE

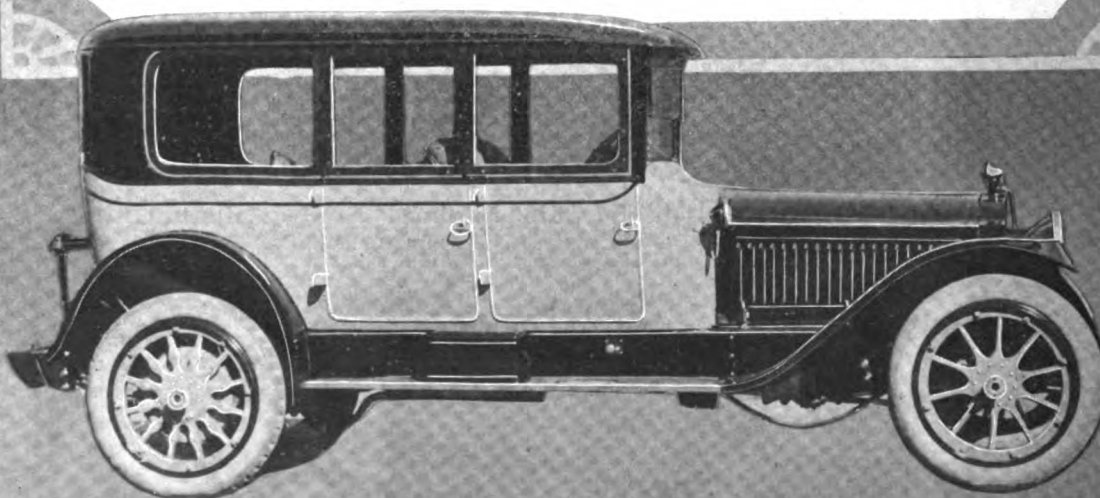
Is ideal motor car equipment, but neither the open nor the enclosed body will serve the entire year, no matter what the design.

Springfield Convertible Bodies, specially constructed for constant use, trimmed and finished to afford the greatest protection, comfort and luxury, meet the requirements of the most exacting owner at any season and for every purpose.

The owner has almost instantly available all of the qualities of both open and closed cars, no body space is sacrificed, appearance is maintained, and the top may be raised or lowered almost as quickly as that ordinarily used.

These bodies are built for any size of chassis and are trimmed and finished to satisfy individual ideas.

Detailed information at request.



SPRINGFIELD METAL BODY CO. SPRINGFIELD, MASS.

A TYPE *for every* GASOLINE MOTOR

Regular $\frac{7}{8}$ " 18 S. A. E. Long Type

Curtiss Aeroplane Type

Standard S. A. E. $\frac{7}{8}$ " O. E. Dayton Motorcycle and Princess Automobile Equipment

Metric Long Type Mack and Sauer Truck Equipment

SPLITDORF COMMON SENSE SPARK PLUGS

Standard S. A. E. $\frac{7}{8}$ " C. E.

Jeffery, Morton, Vin and Wichita Falls Truck Equipment

Franklin Equipment

Heavy Hex Open End

Butch Type

$\frac{1}{2}$ " O. E. Long Special Type for Ford Cars

Standard $\frac{1}{2}$ " O. E. Overland and Pullman Equipment

Metz Equipment

Automobile Metric Type

Excelsior Motorcycle Equipment

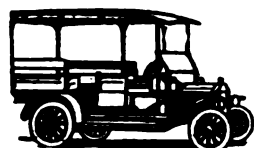
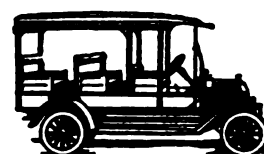
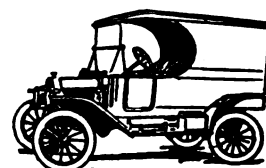
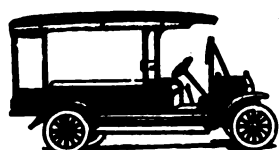
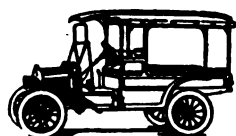
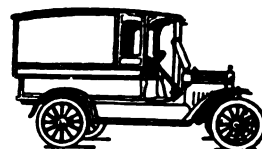
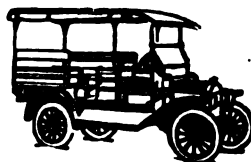
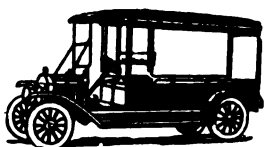
Pope Motorcycle Equipment

S. A. E. $\frac{7}{8}$ " 18 O. E. Indian 1916 Equipment

Standard Motorcycle Type

Indian Metric Type 1914-15 Equipment

AND NO GASOLINE MOTOR IS COMPLETE WITHOUT SPLITDORF SPARK PLUGS



*When You Need
a Body*

SEE

COTTON



See at Boston Show Spaces 331-334 Inclusive

L. M. COTTON, Inc.

America's Leading Body Specialists

922 Commonwealth Ave., Boston, Mass.

Hassler
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Shock Absorbers

FOSTORIA LIGHT CAR



\$ 675
COMPLETELY EQUIPPED

Announcing—

The Surprise Car of 1916

Read These Specifications

MOTOR—Sterling 4 cylinder valve-in-head; 3x4½; full 26 hp.

TRANSMISSION—3 speeds forward and reverse, in unit with motor; dry disc clutch.

WHEELBASE—108 inches.

SPRINGS—Semi-elliptic front; **CANTILEVER** rear—same type as used in latest \$2000 to \$3000 cars.

FUEL FEED—Stewart-Vacuum system with 15 gal. tank—same system found on high priced cars.

ELECTRICAL SYSTEM—Full electric starting and lighting system.

CARBURETOR—Zenith.

IGNITION—A t w a t e r - K e n t, Unisparker, automatic.

STEERING GEAR—Worm and sector type, with Neville folding More-Room wheel, permitting easy access from either side.

COOLING SYSTEM—Thermo-syphon with large cellular radiator.

WEIGHT—1910 pounds with full equipment.

TIRES AND RIMS—30x3¼ tires, non-skid rear; Demountable rims.

EQUIPMENT—Complete, of standard quality.

—a full-size, powerful, handsome, **standardized** car, completely equipped, selling at the price of undersized cars;

—in power, wheelbase and appearance equal to or greater than well known cars that sell for \$1,000 and upwards;

—possessing advanced features in accessibility, easy riding and freedom-from-friction not yet found in **any other cars**—except a limited few of the highest priced.

Ample Capital and Many Years

of success in vehicle building are back of the "Fostoria" Light Car. This company is owned and managed by a group of business men, bankers and production experts, whose wealth runs into the millions and whose name has spelled **SUCCESS** to products that are household words throughout America today.

References: Dun, Bradstreet or any bank in Fostoria.

DEALERS: The Fostoria line is complete, including Touring Car, Roadster, Coupe, Speedster and two Styles Delivery Car. No lost prospects—a style for every service requirement.

Wire, Write or Call for Open Territory

See our exhibit space 217, Boston Auto Show

THE FOSTORIA LIGHT CAR CO., Atlanta Ave., Fostoria, Ohio



World's Champion

"By Right of Conquest"

THE SAME engineering ability, the same care in construction, and the same honesty of purpose and knowledge which made the Stutz World's Champion, will effect the stamina and quality of the Stutz stock car, because stamina and worth are inherent in all Stutz cars. Stutz cars now hold these records:

World's Speedway Champion

World's Road-Race Champion

World's Long-Distance Records
250, 300 and 350 miles

World's Record for Consistency
4 consecutive firsts and seconds

Illustrated Literature on Request

Stutz Motor Car Co.

Indianapolis

Indiana

*Prices range from
\$2000 to \$2550*





The STERLING NEW YORK The Inexpensive Car of Class

Once in a great while, through a combination of favorable conditions, a product is created that immediately takes a distinctive place among its competitors.

Thus, the Sterling New York Car, unheard of a year ago, is today conceded by those who know, to be "The Best Buy" in its field.

In appearance, in sturdy construction, in low cost of operation and upkeep, there is no comparison—it stands alone.

The organization back of the Sterling—New York, combines conservatism with an aggressive business policy that will keep this car in the enviable position accorded it upon its introduction.

*The worth of an automobile is measured
by the ability of its designer*

Mr. Joseph A. Anglada who designed the Model B Sterling New York, is an engineer of national reputation. The use of his services by such prominent concerns as, H. H. Westinghouse Interests, U. S. Industrial Alcohol Co., Anderson Automobile Co., Standard Oil Co., Nott Fire Engine Co., Milwaukee Locomotive Mfg. Co., and the Universal Rim Co., vouch for his ability. For a number of years he has held high official position in the Society of Automobile Engineers. The Sterling New York is his latest and best car. It is the car you will buy when you compare it point by point, dollar for dollar, with any car on the market today.

Dealers—Write for our proposition

There are a few exceptionally good territories still open for the right men. If you act quickly you may secure one. They are being closed rapidly, so act now.

Address Sales Department, 8 Central Park West.

STERLING AUTOMOBILE MFG. CO. Inc., of New York

£ Entirely \$595 Equipped £

F. O. B. FACTORY, Paterson, N. J.

(When Writing to Advertisers, Please Mention The Automobile Journal.)



“He Didn’t Have Pyrene”



This automobile was completely destroyed by fire at Belmont Park Race track, New York, a short time ago. Aside from the loss of the machine what might not have happened had there been old people or women and children in the car? If it had been an enclosed and curtained car with people in it?

Pyrene equipment would have saved the car. It would have saved the lives of the passengers whoever they were.

So well is the protective value of Pyrene known for any service—on the road, in the garage, in the parking place—that your insurance company will re-

duce the amount of your premium 15 per cent if the car is Pyrene equipped.

This rebate will more than pay the cost of Pyrene equipment. Can you wonder that there are so many cars carrying Pyrene?

A Pyrene fire extinguisher is small, compact, light and ornamental. It can be placed anywhere in a car. Any boy or girl can operate it. It is always available, always dependable and will last indefinitely. It is the most economical car insurance known.

You can buy Pyrene from any auto supply house, automobile or hardware dealer. They recommend, sell and use it. Be safe against fire, protected all the time. Why not act today before it is too late.

Pyrene FIRE
EXTINGUISHERS

Our booklet “The Vital Five Minutes” at request

PYRENE CO. OF NEW ENGLAND
88 Broad Street, Boston, Mass.

(When Writing to Advertisers, Please Mention The Automobile Journal.)

Overland
TRADE MARK REG.

MODEL 75
\$615
Roadster #595
for Toledo.



Its Completeness! Won Instant Success

Never before has any model been such a complete and instantaneous success.

Small wonder, really.

For never before has there been so complete a car at anywhere near so low a price.

It stands out alone—boldly—conspicuously—unapproached—a powerful five passenger touring car *complete* for only \$615.

Note that word “complete.”

That means electric starter and electric lights, electric horn, magnetic speedometer—in fact every necessary item. Nothing is lacking. There are *no* extras to buy.

Note that the motor is the very latest *en bloc* design—the last word in fine engineering.

Note that the tires are four inch size. Many cars costing more have smaller tires.

Note that the rear springs are the famous cantilever type. Many bigger more expensive cars are nowhere near as easy riding.

Note the headlight dimmers—the electric control buttons on steering column—demountable rims and one man top—all big features—high-priced-car features.

And it is a perfect beauty—snappy, stylish, speedy.

No wonder there's a rush to possess the car the world has been waiting for.

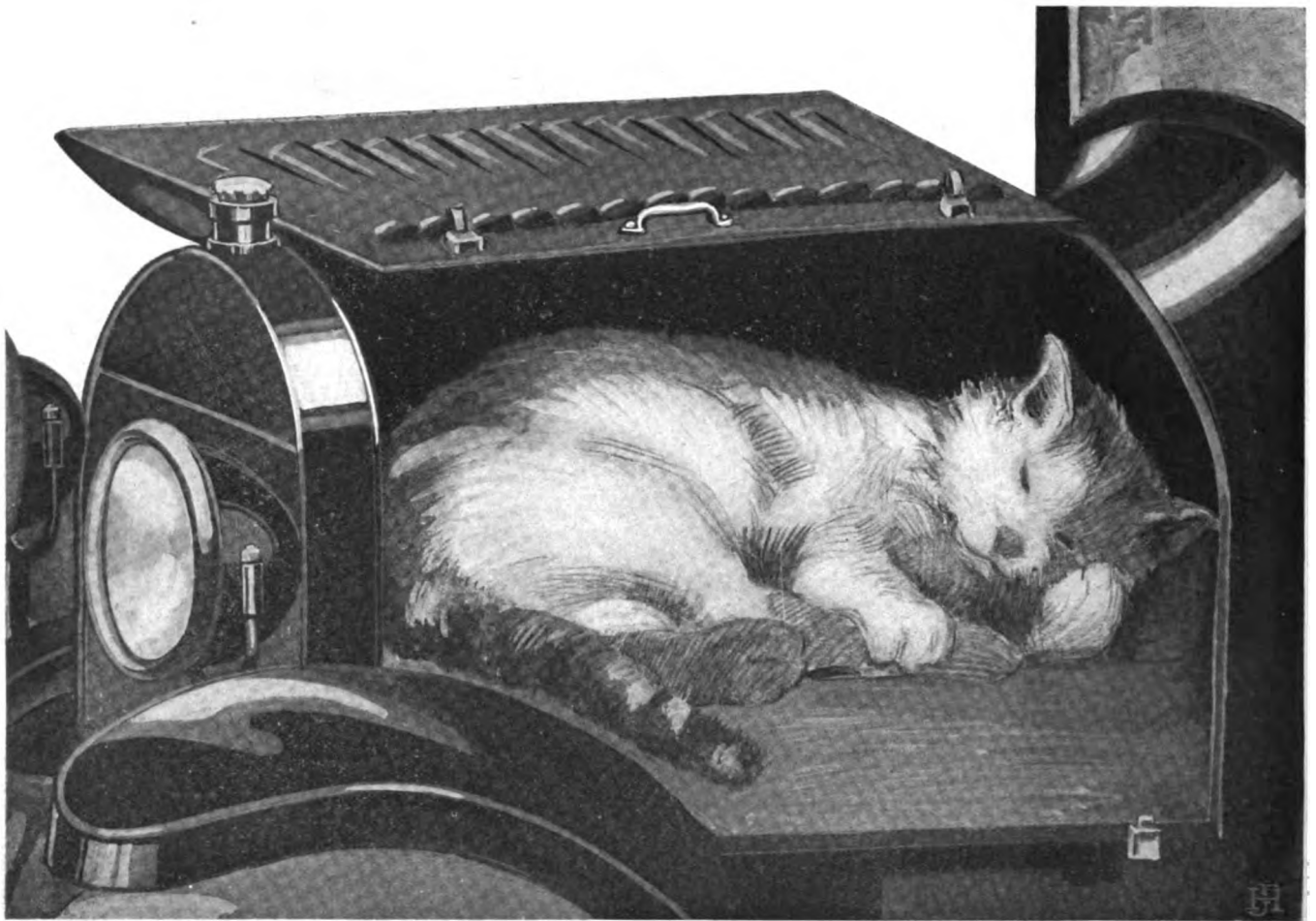
But that means quick action on your part in order to get a prompt delivery.

Don't delay—get your order in today.

Remember it comes complete—only \$615.


The Willys-Overland Company, Toledo, Ohio

“Made in U. S. A.”



IT PURRS Like a Contented Kitten

A smooth, resistless flow of power without a break or skip—just the low humming sound of the motor as it swings the car up over the crest of a hill. ¶ Just its deep, slow, peaceful breathing as it creeps through the congested down-town traffic—its lightning response to the throttle as you “step on her tail” to circle that slow-moving truck. ¶ That's what you get when you have perfect ignition—that's what you get when you use

JUMBO
 **SPARK PLUGS**

You who drive cars and make your bread and butter selling cars and accessories, know what an amount of trouble can be caused by broken porcelains. This seldom happens with the Jumbo Spark Plug because the hammer-like blows of explosion against the porcelain are cushioned by big, elastic, copper-asbestos washers spaced much farther apart than in the usual construction. An extra central insulator insures continuity of spark in case the porcelain should ever, by any chance, be cracked or broken.

Every Jumbo Plug that leaves our works carries with it

The Jumbo Guarantee

which is our guarantee to replace without extra cost any Jumbo Plug which develops any defect or in any way fails of giving complete satisfaction within 365 days of the date of purchase.

Any dealer who will write us on his own letterhead can have a plug for trial. If the most severe tests you can think of do not fully prove its absolute superiority over every other plug made in America we won't request your future business.

Ask also for descriptive circular, prices, and quantity discounts.

Gibson-Hollister Mfg. Co., 3380 Washington Street
 Jamaica Plain, Mass.

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(69-16)

RIGHT THROUGH *the* WINTER

Don't let winter lock the door of your garage. Use

Polarine

The Standard Oil for All Motors

and you can keep your car running right, even on the coldest day.

To be sure of getting genuine Polarine, buy it in the sealed one gallon and five gallon cans.

STANDARD OIL COMPANY OF NEW YORK

(Principal Offices)

New York
Buffalo

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EISEMANN

MAGNETOS

*The Most Efficient
The Most Durable
The Most Simple
The Most Accessible
Magneto Ever Produced*



(Type G-4)

EISEMANN

MAGNETOS

have been adopted as standard equipment by
the great ignition experts of

108 Manufacturers

—the largest in the country—including

72 Trucks
11 Pleasure Cars
25 Miscellaneous
(Tractors, Mining Machinery,
Stationary Engines,
Gasoline Locomotives, etc.)

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THE EISNER-LENK CO.

1096 Boylston St., Boston

Exhibiting at the Boston Show, No. 554, Dept. F.

THE EISEMANN MAGNETO CO.

Sales and General Offices:

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ACCESIBLE equally from all railroad terminals, by subways, trolley lines and all roads entering Boston from any direction—one block from Mechanics' Hall, the location of the Boston Automobile and Motor Truck Show, it is the

Boston Rendezvous

*FOR NEW ENGLAND
MOTORISTS AND TOURISTS*

Close to all leading theatres and smart shops, to many of the principal places of interest, and the Headquarters of the Bay State Automobile Association.

Unsurpassed for cuisine and service, with every room having outside exposure, and every convenience and appointment to satisfy the most exacting guest.

*Uniformed porters and taxicabs
meet all incoming through trains.*

RATES BY THE DAY:

Single Rooms (running water)	- -	\$2—\$2.50
Single Room with bath	- - -	\$2.50—\$4
Double Room (running water)	- - -	\$3—\$4
Double Room with bath	- - -	\$3.50—\$5
Suites (parlor, bedroom and bath)	- -	\$8—\$12

HOTEL LENOX

L. C. PRIOR, Manager and Lessee

Boylston and Exeter Streets

BOSTON, MASS.



Seven Passenger—Six Cylinder—\$1185

They said we couldn't do it—but we did

When just one year ago I expressed a determination to build a seven-passenger, six-cylinder automobile—light in weight, economical in gasoline and tires, with plenty of room and—All those detail refinements associated with highest priced cars, yet—

Stocky, sturdy, finely upholstered in real leather, easy riding, and—Sell this car at \$1185, they said—“It can't be done.”

They said: “It is foolish to think of building a roomy, thoroughly comfortable seven passenger car on a 120 inch wheelbase.

They said: “You can't use 100% thrust genuine annular ball bearings in the front wheels.”

They said: “You can't use genuine imported Sheffield steel springs.”

They said: “You can't use an axle as sturdy and as expensively built as those being used on the other cars selling at from two to four hundred dollars more.”

They said: “You can't build a thoroughly comfortable and roomy seven passenger six and keep the weight down under 2700 lbs.”

They said: “You can't hand paint the car, using twenty coats of paint and the finest finish varnish.”

They said: “You can't use the genuine long grain bright finish leather.”

They said: “You can't build into a car, at this price, all of the style and snappiness demanded by the purchasers of high grade seven passenger cars.”

And they kept on coining “can'ts” and shooting them at me until they had me wavering for a moment.

But I believed it could be done, and I finally found, one by one, a corps of men of wide experience and proven strength in the doing of things that are hard to do, who believed with me that it could be done.

And when we all agreed unanimously that it could be done we took off our coats, rolled up our sleeves and said—“We'll do it.”

And now, after just one year, by infinite attention to even the smallest detail—

By the utilization of every inch and fractional inch of space—

By the most careful and scientific balancing of every part and unit—

By the most thorough search of the world's markets for the best materials of the lightest weight—

And above all, with the one fixed purpose in mind that—it can be done—must be done—will be done—we have done it. The car is a revelation of what can be done when a group of capable workers set their hearts to a task with unswerving courage and determination.

J. I. HANDLEY, Pres.

Our Full 1916 Line of Sixes Exclusively

MARION SIX
Five-Passenger Touring, \$1090
Five-Passenger Sedan, \$1190

MARION-HANDLEY
Seven-Passenger Touring, \$1185
Four-Passenger Roadster, \$1185

Our proposition for dealers is attractive—our factory and advertising support the kind that counts. Write for complete literature and full particulars.

THE MUTUAL MOTORS COMPANY

Jackson, Michigan



It's the same old COES

How often have you heard the repairman, machinist or shop manager say, "It's the same old Coes, just as good as the day I bought it—it will last forever."

That is evidence of the quality that has made Coes wrenches the standard the world over.

Coes Wrenches made today are just as good as the Coes Wrenches produced 50 years ago.

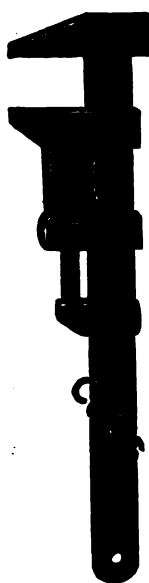
The material is selected with the same care, made by equally experienced and trained wrench makers, in a factory which specializes in wrench making. The wrenches are finished carefully and many times tested to assure the quality that will meet every requirement placed upon them.

Car owners who know wrench values demand the Coes. It is most popular with automobile repairmen, and in every other line of mechanical work Coes wrenches will be found on the benches and in the tool kits of the expert workmen.

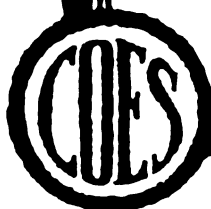
Coes wrenches can be had in just the size to fit any use. Any Coes will afford the same long and satisfactory service. It is always dependable and from the standpoint of wrench service it is the cheapest wrench produced.

Coes wrenches are sold wherever motor cars are used. They may be had of all jobbers, automobile supply houses, and automobile and hardware dealers.

Catalogue on request.



Coes Wrench Company, Worcester, Mass.



(When Writing to Advertisers, Please Mention The Automobile Journal.)



The LOCOMOBILE POLICY

To continue to build a limited number of Motor Cars of the very highest excellence.

To make a finer car, a more expensive car; not a cheaper car, or more cars.

To use even finer materials, to develop even finer workmanship.

To maintain and develop the highest efficiency in our manufacturing organization, rather than increase its size.

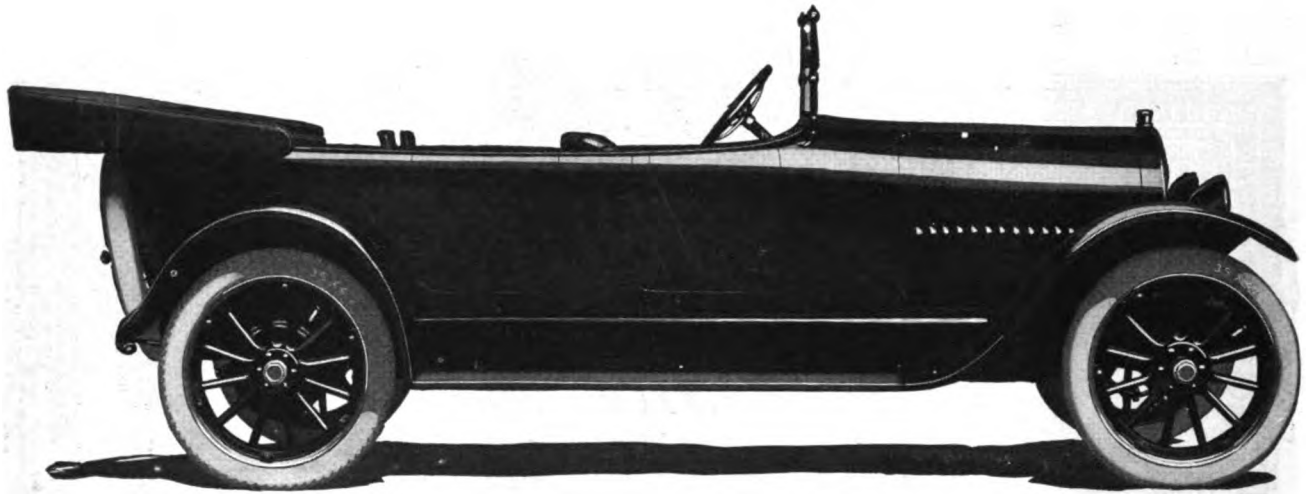
To continue to build six-cylinder motor cars with four-speed transmissions; large cars and not small cars; and not more than "Four Cars a Day."

To introduce into our product an even more luxurious quality, an even more aristocratic note.

To make the Locomobile even more distinctive and more desirable.

To have the price of the Locomobile result from its high quality, simply a function of cost, and higher as the cost is higher.

THE LOCOMOBILE COMPANY *of* AMERICA
Makers of Fine Motor Cars



Jeffery Announces A New Light-Weight High-Power Six

THE New Jeffery Six is a remarkable combination of practically unlimited speed and power with unusual beauty and supreme comfort.

The phenomenal performance of this car through apparently impassable mud and sand, the effortless ease with which it soars up incredible grades on "high"—these are a few of the astonishing qualities which have demonstrated the fitness of the Jeffery Six to take its place like every other Jeffery production

—as the undisputed leader of its field.

Motor 6 cylinder en bloc, high speed, high efficiency. Unit power plant.

Wheel Base—121 inches.

High tension magneto ignition.

Electric two-unit 6 volt system used elsewhere by highest priced cars only.

Artillery type wheels, Stanweld demountable rims; straight side tires, 35 x 4½ inches, all weather tread rear.

Brakes—Service brakes, external contracting on rear wheels. Emergency brake, external contracting on brake drum mounted on propeller shaft at rear of transmission.

Shipping Weight of Car—3050 pounds.

Body—Roll edge type. Divided front seat. Driver's seat adjustable.

Auxiliary seats concealed underneath front seats when folded.

Price—\$1450 f. o. b. Kenosha.

See the New Jeffery Six at the Boston Show

New England Distributor:

C. P. ROCKWELL, Inc.

640 Commonwealth Ave., Boston, Mass.

The Thomas B. Jeffery Company
Main Office and Works, Kenosha, Wisconsin



(When Writing to Advertisers, Please Mention The Automobile Journal.)

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The Most Skeptical Dealer in America.

Specifications.

Full 7-passenger body.
Deep and luxurious
upholstering.
Wide doors.
Concealed auxiliary
seats.
Two unit starting and
lighting systems.
80 H. P. Eight Cylinder.
Herschell-Spillman Motor
3/4x 5 cast en bloc.
130 inch wheelbase.
Zenith carbureter.
Aluminum crank case.
Full-floating rear axle.
57-inch semi-elliptic
rear springs.
Stewart-Warner
vacuum system.
Tank 18½ gallons.
One-man "Never-leak"
top.
Built-in rain-vision
windshield.
Weight 3100 pounds.

One of the visitors at the Ross Automobile Company's factory this month was unusually thorough in his inspection of everything but made no comment at all. When he returned to the office, he broke his long silence. "I'm George _____," he said. "Just came from Chicago. Saw your car there, and wanted to take it on. *But I couldn't believe that you were building cars as good as that sample to sell for \$1350---until I came here and saw with my own eyes.*" This man arranged on the spot to close for the Ross agency.

This is a true story. The dealer's name will be furnished on application.

We want more such skeptical dealers. We shall not exhibit at the Boston Show; but soon after we shall send a car to Boston to show to interested parties. Meanwhile, we invite correspondence to arrange appointments. If you are interested, write at once or wire.

Study the specifications of the Ross Eight. Be as skeptical as you like---we prefer them that way.

Ross

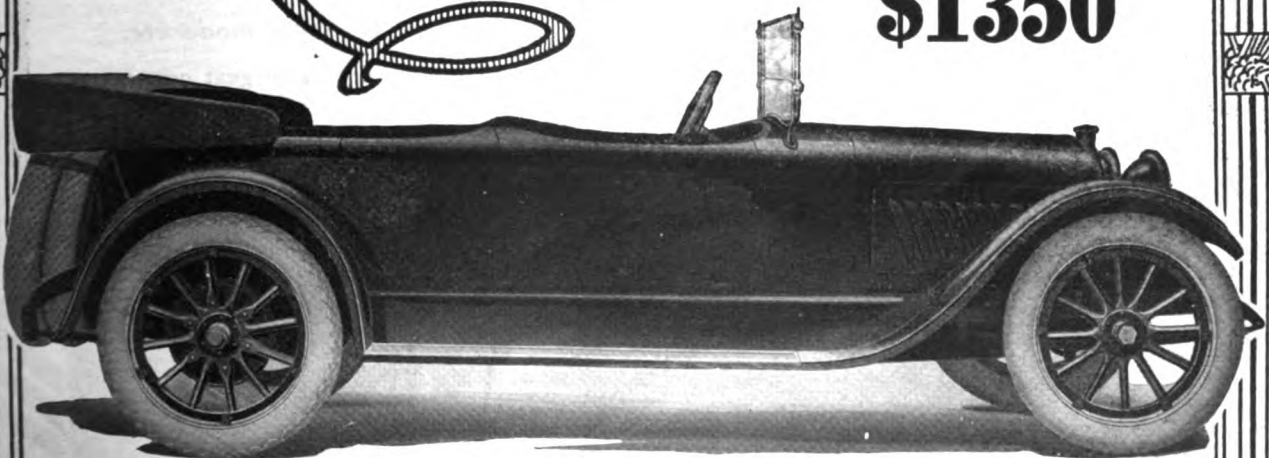
EIGHT

ROSS AUTOMOBILE CO.

(Ross & Young Machine Co.)

Detroit, - - - Michigan

\$1350



The AUTO CLEANER and POLISH PAR EXCELLENCE



Victrolene

CLEANS and POLISHES AT ONE TIME

The cleanser that will neutralize tar, tarvia or road oil and instantly remove it without affecting the finish of an automobile body.

It will preserve and restore the varnish or enamel of a car to a condition that will equal the original.

Do you realize that cleaning and polishing with Victrolene means a distinct saving of time and labor?

It is neither combustible nor poisonous, and will not stain metal.

It is perfectly compounded and as there can be no precipitation *it is uniform in quality from the top to the bottom of the container.*

It is used with a soft cloth,—one moistened with Victrolene for the cleansing, and a dry one for polishing.

Victrolene is a guaranteed product. The price is extremely moderate.

A sample bottle containing sufficient Victrolene to polish the largest car, sent post paid on receipt of 10 cents.

DORSEY MANUFACTURING COMPANY
80 BROAD STREET BOSTON, MASS.



*Demonstrated at the
Boston Automobile
Show, Space 411,
Department E.*



Service—the Criterion of Our Owners

DORT



THE DORT, in making good with its owners, has automatically made good with its dealers.

Its low cost of maintenance and remarkable economy have strengthened the feeling of co-operation between owner and dealer.

Time has proved this

Those dealers who last year were skeptical are now convinced by their own balance sheets that there is an extra margin of profit in handling the Dort; because of the continuous motoring satisfaction the Dort gives under every condition of service—and this with a minimum of service expense to the dealer.

To visit the Dort exhibit at the Boston Show is to witness an exchange of experiences between Dort owners and dealers—experiences that conclusively prove that the Dort makes good every time—all the time.

The 1916 Dort, sturdily built for every condition of motor car service, will be prominently displayed at the Boston Show.

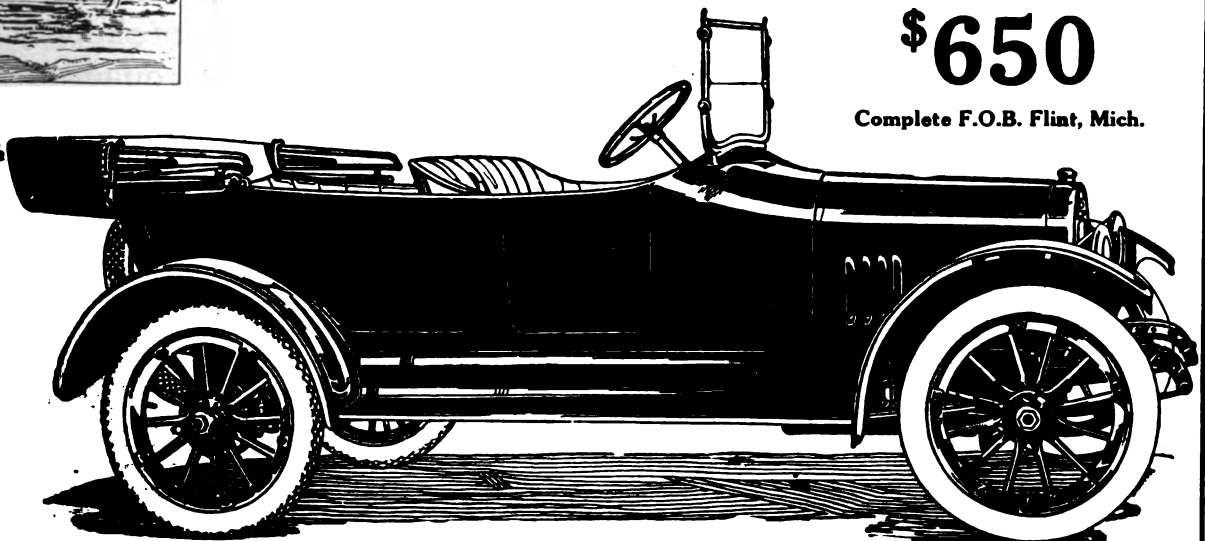
Don't miss the Dort. No motor car on the American market today has made such rapid strides in the favor of the buying public as well as the technical men of the industry—and no motor car gives as much for the money as the Dort.

DORT MOTOR CAR COMPANY

Flint, Mich.

\$650

Complete F.O.B. Flint, Mich.



*In the
deepest snow*



*On the
steepest hills*

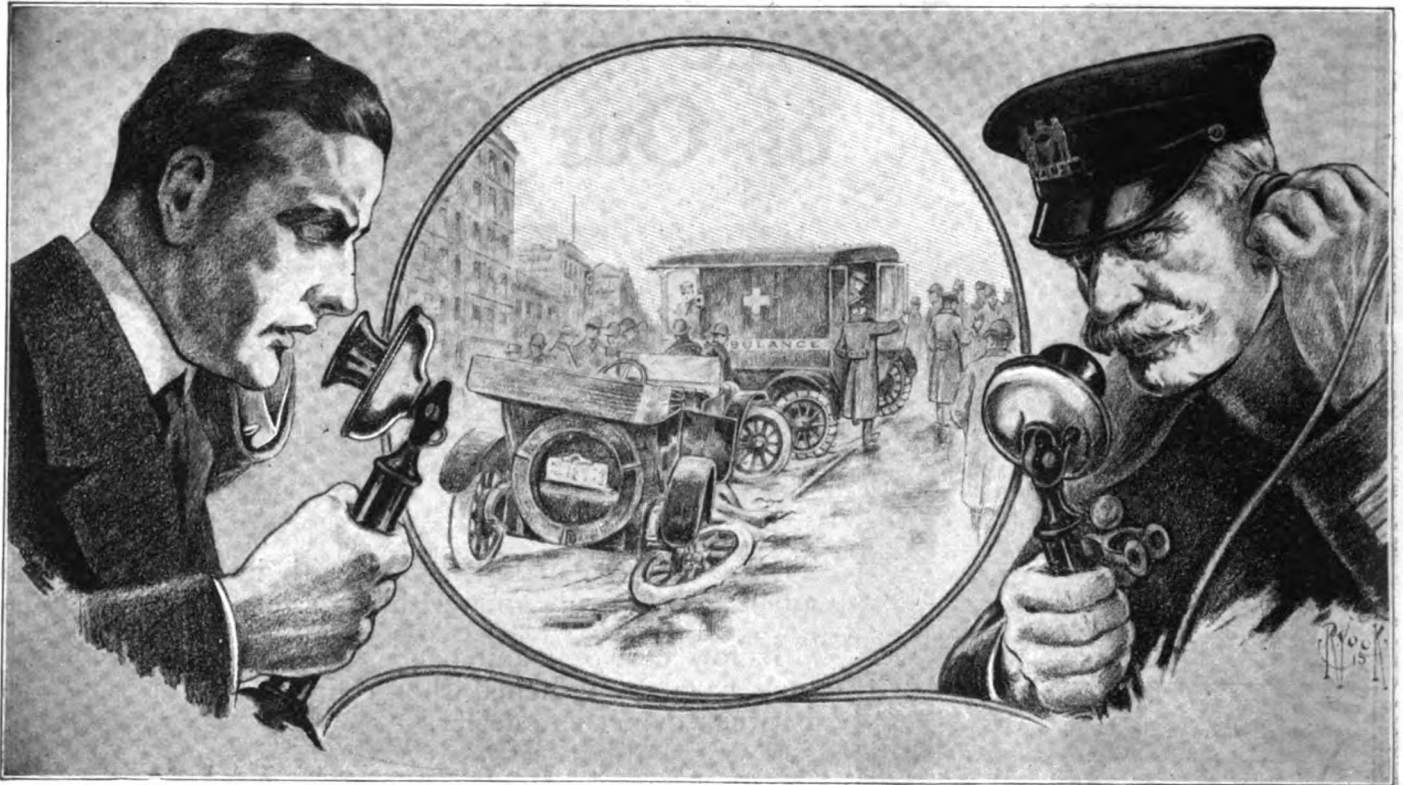


*In crowded
traffic*



*Through
mud and slush*

(When Writing to Advertisers, Please Mention The Automobile Journal.)



“What! My Car?”

“Yes! skidded—and it’s up to you. You failed to provide the chauffeur with Tire Chains. Only good luck saved your wife from paying the supreme penalty for your negligence. She’s on the way to the hospital, painfully injured, but the doctor thinks she’ll pull through. You’d better hurry to the hospital and then report to Headquarters”.

How strange it is that disaster must come to some men before they realize that all makes and types of tires will skid on wet pavements and muddy roads when not equipped with Chains.

These men do not appreciate, until too late, that by failing to provide Weed Anti-Skid Chains they expose

their families to injury and death.

The time to provide against accidents is before they happen. Don’t wait until after the first skid. Put Weed Chains on all four tires at the first indication of slippery going and you will have quadruple protection against injury, death, car damage and law suits.

Weed Chains are Sold for All Tires by Dealers Everywhere

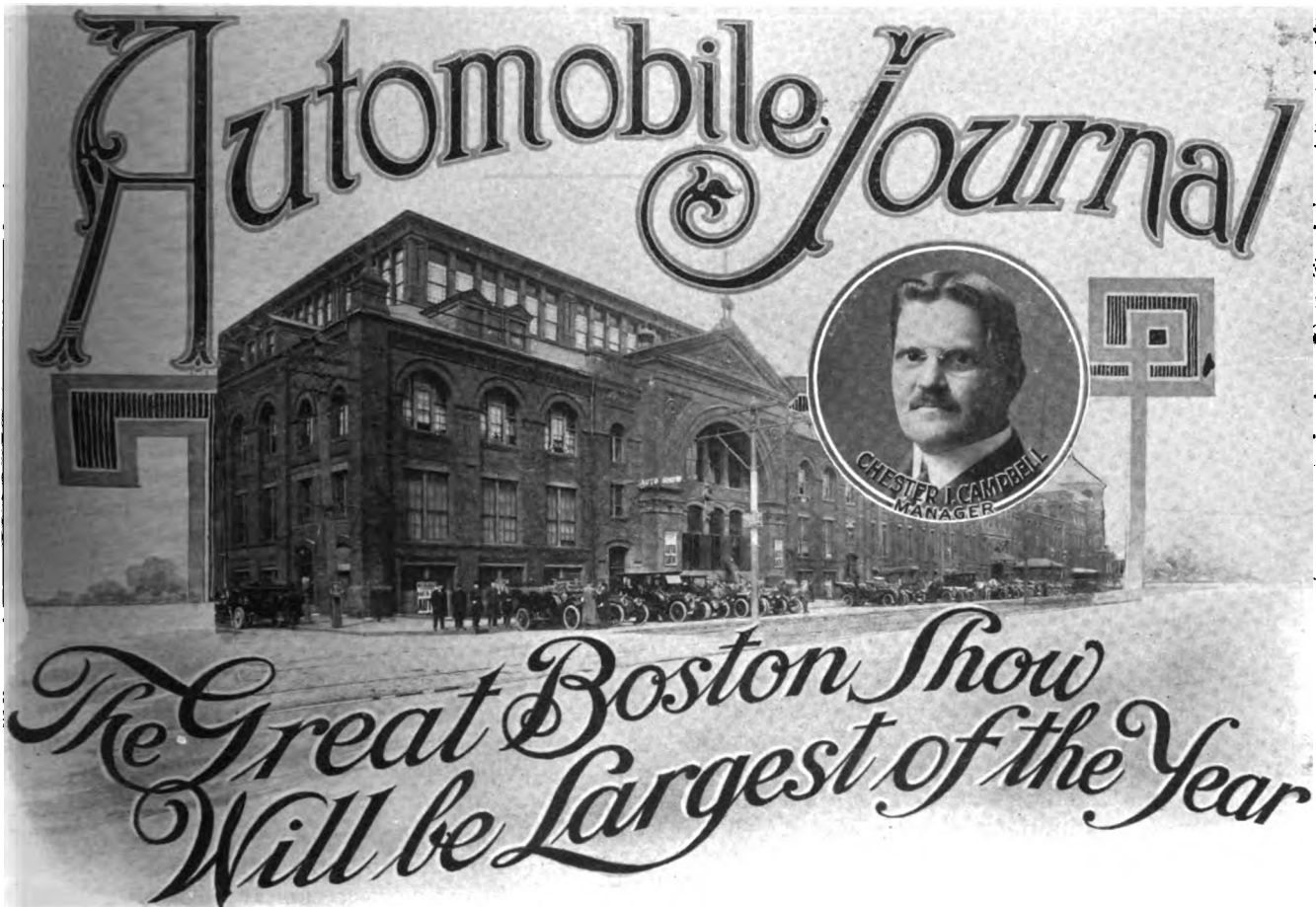
AMERICAN CHAIN CO., INC., BRIDGEPORT, CONN.

Sole Manufacturers of Weed Anti-Skid Chains

In Canada—DOMINION CHAIN CO., Ltd., Niagara Falls, Ontario.



(When Writing to Advertisers, Please Mention The Automobile Journal.)



Twice in Recent Years Has Mechanics' Building Housed the World's Greatest Exhibition of Motor Vehicles, Not Excepting the Shows in London and Paris.

FOR years the Boston show has been known as the largest in the United States in the number of exhibits, attendance and volume of business done. Twice has it been acknowledged as the biggest in the world. This year it will be even larger than usual, and yet owing to limitations of space it will not include nearly all the exhibitors who would like to secure reservations.

No less than 22 makers of passenger cars and trucks desiring representation in the display have been unable to secure the space, and a very large number of accessory exhibitors also have not been able to secure accommodation.

In fact, the pressure of makers seeking representation has been so large that it is probable that next year it will be necessary to return to the system of two shows—one for passenger cars and one for trucks. The great progress that the truck industry is making will probably bring the

truck show back in all the leading centres next year.

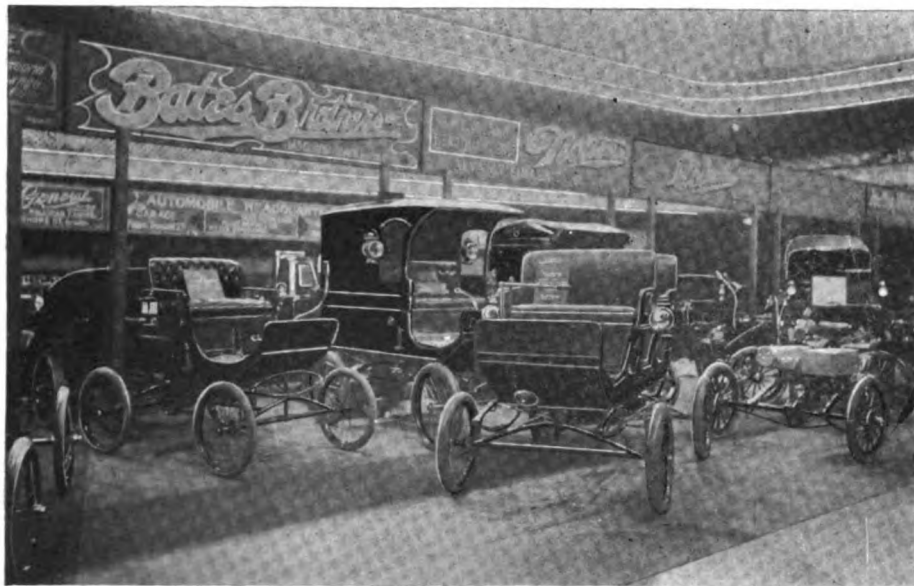
The Mechanics building in which the show will be held this year, as it has every year since 1904, will house 74 makes of cars and 33 makes of trucks, with a total of nearly 450 different models. Grand hall and Exhibition hall will be occupied by passenger cars, and there will be seven makes in the balcony. Paul Revere hall, which has usually been reserved for accessories, will be taken up by a make of passenger cars, and there will be 33 truck exhibits in the basement. The B4 accessory exhibitors will occupy the remaining space in the balcony.

Gasoline cars will predominate at this show to a greater degree than previously. Two makes of electric vehicles and trucks will be shown, and one steamer. The rest all draw their motive power from gasoline engines.

The show is one of the greatest dealers' gatherings in the country; last year 4000 from New Eng-



One of the Early Shows in Mechanics' Hall, at the Time When General Interest in Motor Vehicles Was Becoming Evident.



The Boston Automobile Show of 1902, When Automobiles Were Generally Called Horseless Carriages.

land and other northeastern states were present. There were 3000 exhibitors' tickets issued, so that the total trade attendance reached a figure somewhat above 7000. There is every reason to believe that this trade attendance, which is so important to makers seeking distribution, will be even larger this year.

In spite of the marked shortage of space there will this year be over 125,000 feet available, or more than six acres. The decorations will cost \$40,000 and will include the use of from five to six hundred electric lights. The week will be punctuated by hundreds of banquets to sales forces and gatherings of trade associations.

The show management puts on every year at Copley Plaza hotel a great "round up" of New England automobile interests. Last year this dinner was attended by more than 600 men.

The average cost of the models that were displayed this year at New York and Chicago was about \$1600 each. At Boston, where the high priced car is proportionately stronger, the average cost will be nearer \$2500, which will bring the value of the exhibits to approximately \$1,000,000, not to mention the accessories.

Some Imported Cars Present.

In Boston the imported cars are a part of the regular showing. The war and the more complete dominance of the American car, even in the highest priced field, has cut down this section of the show considerably, but the Renault, Rölls-Royce and Lancia cars will be shown.

In spite of the lack of space six new cars that have not previously been displayed in Boston, will be on exhibition. One of these will be an Owen Magnetic gas electric model. This car is rapidly winning favor and 34 of them are

said to have been sold in Boston during the past two or three months. Other new models on display will be the Fostoria, Bell, Daniels Eight, Hollier Eight and the S. J. R., which is a luxurious roadster produced in Boston.

The show will be opened Saturday, March 4, and will be continued each week day until the evening of March 11.

Numerous facilities will be installed for the benefit of visitors and exhibitors. In Mechanics' hall there will be a barber shop, a restaurant and a telephone exchange capable of handling from 7000 to 8000 calls every day.

Decorations Renaissance Style.

The decorations are different from those of any previous automobile show. The modern renaissance style has been adopted to transform the interior into a strikingly attractive setting for the cars.

The promenade in Exhibition hall has been arched in crystal, more than 200,000 electrically lighted pendants being used. The entrance to the main stairway is spanned by 10 brilliant arches. Every column in this section of the building is panelled in black and white stripes and has as a capital four dull gold cupids, which hold illuminated bird shaped lights.

From post to post elliptical arches in dark foliage, edged with electric bulbs, extend in all directions. Filagree work in Renaissance style conceals the windows without reducing the volume of light. Black marble pedestals support the bronze sign posts, which have the exhibitors names on large glass globes. Pierced work gives a rich effect to the high back grounds which divide the exhibits, the lower portions of the partitions having the same vertical black and white treatment as the columns.

Grand hall is roofed by a glistening arrangement



The First Dealers Show in Symphony Hall, 1903.



View of the 1907 Show, the First at Which the Apple Blossoms Were Used as a Decorative Feature.

of lighting effects in crystal color and design. The stage setting includes a great illuminated painting, 40 by 150 feet. The stairway to the stage is treated in black and gold vertical panels, and there is a wrought iron entrance to gardens. Large illuminated glass columns support the sign globes on the stage. Wrought iron railings, tall electroliers and marble fronts are other features of the decorative treatment of the stage.

Proscenium Curtains Remarkable.

The 150-foot proscenium arch curtain is especially striking. It consists of a floral screen pierced with delicate and spring like branches, leaves and flowers. The same treatment is carried out on all brackets and truss work. The curved balconies or bays, which overhang the main hall, are divided by rich carved panels out of which project hand wrought dull bronze lanterns. On the wall opposite the stage is a large background in three panels.

The central structure on the main floor consists of eight columns, which support finely modelled Herculean figures, carrying a great auto wheel on their bent shoulders. These figures represent industry, progress, invention and success. Above all, in the centre, is a figure of prosperity with a full cornucopia. The tire of the wheel, the spokes and the cornucopia are brilliant with hundreds of electric lights.

The first display of motor vehicles in the United States was held in Boston, and although the present show is known officially as the 14th, it is really the 18th. It is the 14th to be held under the auspices of the Boston Automobile Dealers' association; but before that organization came into existence four shows had been given in connection with the biennial Mechanic Fair.

Greatest American Show.

From the beginning the Boston show has been one of the three greatest and often the greatest in the United States. This is true whether considered from the viewpoint of the number and variety of the displays, the attendance, or the amount of business done. The business has included large numbers of transactions with dealers by the manufacturers' wholesale depart-

ments and Boston distributors, most of whom cover the New England territory, or of actual sales to retail buyers.

The first showing of motor vehicles—then known as horseless carriages—was made in 1896 in Mechanics hall (the same building that will house this year's show), in connection with the Mechanics' Fair.

On that occasion there were three vehicles on display. One was driven by steam and another by gasoline. The third was an imported tricycle, which also was propelled by gasoline. They

formed a portion of the bicycle exhibit in the basement of the building. During its early years the motor vehicle was associated in the public's mind with the bicycle and at that time it was largely in the hands of bicycle men.

Two years later another exhibition of motor vehicles was made under similar auspices. The number of cars on that occasion had increased to five or six.

New York's first automobile show was held in the fall of 1899 and this too was a part of the annual exhibition of bicycles. It was given in the Madison Square Garden, where the shows continued to be held for many years. The next year, 1900, the first strictly automobile show of the national type was held there.

In this year there was no automobile display in Boston, but in 1901 a more or less private exhibition was held in the Automobile Headquarters, which had then been established as a salesroom in Stanhope street. It was held in connection with the formal opening of that establishment as a garage by the Underhill company, which for many years, was distributor of Knox cars in Boston.

Auto Club Holds Display.

The success of the New York displays held about this time encouraged the recently organized Massachusetts Automobile Club to hold a show in 1902 in Grand hall, Mechanics' building. This also was in connection with the Mechanics' Fair.

This display was patterned after the national dis-



A Corner in the Display of 1905, Showing the Feature Cars of That Year.



Colonial Decorations Were Used in 1911 to Beautify the Interior.

play in New York. The cars were placed in the middle of the hall, while accessories were arranged under the balcony. There was also a demonstration track on which the cars were operated for the benefit of the public. When these four shows are added to the 14 conducted by the Automobile Dealers' Association, Boston has had in all 18 exhibitions, which is one more than has been held in any other city in the country.

These early shows did a great deal to arouse interest in America in the development of the motor car and were probably the impetus that caused much of the early development work to be done in New England factories.

From the beginning Boston has been one of the big trade centres. The Massachusetts Automobile Club as early as 1903 had its own garage on Boylston street, and was the first in America to operate one on a co-operative basis. Today it is one of the most imposing ventures of the kind in the country. The building is a large and new six-story structure with garage, shops and supply store.

By 1903 interest in motor cars in Boston had reached the point where the local dealers decided that it would be advantageous to organize for the purpose of developing this interest. Ten of the principal dealers deposited \$100 each to pay the expenses of the first show. They appointed the following committee: W. E. Eldridge, George H. Lowe, Harry Fosdick, J. H. MacAlman and Chester I. Campbell. Mr. Campbell was not a dealer, but he had had considerable experience in managing successful bicycle shows at Providence, R. I. He was made show manager, a function that he has performed successfully ever since.

The First Dealer's Show.

This first show was too small to require the space available in the building that has since been used. It was held in Symphony hall. Twenty-one makes of cars were shown and the attendance was 17,360, which indicates the very considerable interest that had already been aroused in motor vehicles.

The following year the Boston Automobile Dealers' association

was formed and the policies on which succeeding shows were to be arranged were formulated. March was chosen as the time for the display because that month comes just before the beginning of the driving season and when interest in motor cars is keen. Mr. Campbell became, and has since remained, general manager of the association.

In the 1904 show manufacturers of motor boats and their accessories exhibited their wares. The display of cars was much larger than it had been previously

and the attendance was 30,000, a number that included a much larger proportion of actual prospective car purchasers than in preceding years. This show was held in the Mechanics' building, where all succeeding exhibitions have been held.

The list of exhibitors at Boston grew rapidly, until, in 1907, it became greater than even those at the national shows in New York and Chicago. The Boston display is the only big show at which the Ford Motor Company has exhibited in several years. In 1907 the total number of makes reached 121, of which six were commercial types. At New York 85 makes of passenger cars and 45 trucks were shown, making 130 for the two exhibitions. Chicago had 96 of both types.

Biggest of the Year.

As a result the Boston show was acclaimed as the biggest single exhibition of the year. The decorations, chiefly consisting of apple blossoms, in keeping with the spring atmosphere, were also generally conceded to be the best. While exact figures are not available, it is declared that the volume of business transacted was the greatest of any of the shows held in 1907.

When the acute business depression of 1907 came upon the country many of the names of makers that were on the list of exhibitors for that year appeared for the last time. The motor boat section was eliminated in 1908 and the number of makes of motor cars was reduced in that year to 84. But the business transacted at the show was large and indicated a quick recovery by the purchasing public.



A Section of the 1911 Show When Lattice Work Was Used for Decorations.



The First Fore Door Cars Shown Were a Feature of the 1910 Display.

As a result of the successful exhibition of the year before the number of makes rose in 1909 to 106, and of these 18 were commercial cars. In 1910 there were 122, of which 25 were industrial vehicles, and in that year the Boston show was again the largest in the country, having 650 different cars on display. This was the greatest number shown in any city at any previous time. The record up to that year was 597 cars, displayed at the Olympia show in London in 1909.

In 1911 a plan was instituted both at New York and Chicago to hold separate shows for pleasure cars and trucks. The Boston dealers, however, felt that the truck had not yet developed to the point where it could well support a separate exhibition, and they continued to display the two types together. The number of exhibitors in that year, however, was so great that additional room had to be secured by utilizing Horticultural hall. The makes totaled 143, of which 41 were commercial. The attendance aggregated 146,363.

There were 70 makes of passenger cars and 35 of trucks at the two New York shows, and 94 and 44 respectively at Chicago. So this year again the Boston dealers' display was the biggest and best in the country.

Big Business in 1912.

In 1912 it was felt that the New England market had reached its greatest development, but the show surprised the exhibitors by producing \$2,000,000 worth of business and an attendance of 225,000. In that year the Boston Commercial Motor Vehicle association was organized and took over the truck show as a separate exhibit. There were 107 makes of passenger cars represented, as against 98 for Chicago and 91 for New York.

In 1913 there were 91 makes of passenger vehicles, as against 90 in New York and 102 in Chicago. In the commercial vehicle exhibit there were 54 different makes. Of these, eight did not appear at the national shows. More than 245,000 people visited the display.

The next year, 1914, the attendance was nearly 300,000. There were 106 different makes—82 gasoline cars, eight electrics, the Stanley steamer and 14 cyclecars, making 318 cars in all. There was a

separate truck show, at which 35 makes were shown. For the total this made 141 makes. In New York there had been only 78 makes and in Chicago 86. Paris at the Salon in the same year had 132 and London 126. The Boston show was again "the greatest on earth."

During the early months of 1915 conditions did not seem propitious for a successful exhibition. However, the exhibitors numbered 71 passenger car makers and 34 commercial car producers. The figures of attendance were not given out, but they were said

to have been close to 300,000. Spectators say that so many people visited the show that there was hardly room to move about in the great building.

During the evening of Society Day, when Governor Walsh visited the exhibit, it was necessary to keep the doors closed for half an hour to prevent the overwhelming flood of people seeking entrance from crowding in and suffocating those within the building, who even then were finding it difficult to move around from one exhibit to the other.

In spite of acute business depression the sales were remarkably large. The volume of shipments from the factories this year is twice as large as last year, which indicates that all records for business will be broken at the forthcoming Boston show.

LENOX HOTEL MOTOR CENTRE.

During Boston show week the Lenox hotel, at Boylston and Exeter streets, one block from Copley square and the Boston public library, will be headquarters for a great number of visiting dealers and manufacturers. The hotel is convenient to the New York, New Haven & Hartford railroad and the Boston & Albany at the Back Bay station, and only a short ride in the subway from the Boston & Maine, Dartmouth street station. The Mechanics' building, where the Boston show is held, is easily reached from the hotel. The Lenox is handsomely furnished and luxurious and in view of the service that is given the rates are attractive.



A New England Orchard Scene in Mechanics Hall During the 1910 Exhibit.



RESULTS of great interest to owners and makers of motor cars were established by the Hyatt Roller Bearing Company, Detroit, Mich., which has just awarded prizes in a contest to determine the greatest distance a car had travelled without renewals on Hyatt roller bearings.

The distances prove to be greater than any one had anticipated. Prizes were awarded to 16 cars which had registered phenomenal mileage. Of these the first was a Buick of the 1909 model and owned by F. E. Slason of Plainville, Kas., which travelled 261,800 miles. This is a distance of more than 10 times around the world.

Seven different makes of cars were represented among the prize winners, and the total mileage made by the 16 cars was 2,512,435, which is more than 100 times around the earth. The average distance for each car was 156,814 miles, or more than six times around the world. All of the cars which received prizes are still operated by their owners.

Mr. Slason, who received the first prize of \$500, declares that more than 300 tires, representing a value of \$8000, have been worn out on his car. In the rear axle from time to time three new bevel ring gears have been used. Other repairs were a new crankshaft, new plain bearings in the motor and piston arms, and the transmission gears have had to be replaced.

In order to locate these cars advertisements were published for several months by the Hyatt company, which offered substantial prizes for information concerning cars that had travelled the greatest distances on the original Hyatt bearings. Thousands of replies were received.

Mileage Claims Investigated.

Those claiming the highest mileages were carefully investigated by the company to substantiate as far as

possible the claims, and the whole mass of information was turned over to a board of three judges, which was made up of men well known in the industry. These were Alfred Reeves, general manager of the Automobile Chamber of Commerce; Coker F. Clarkson, general manager of the Society of Automobile Engineers, and Julian Chase, editor of an automobile trade paper.

Of the various makes using Hyatt roller bearings, the Mitchell had more cars than any other among the prize winners. This car, designed by Charles W. Bate, showed the excellence of its engineering and construction by winning six of the 16 prizes. The Ford was next with four cars represented in the money. Buick, which took the first prize, had two winners.

There was one Flanders, one Logan, one Maytag and one Hudson. The following is the list of winners, who, in addition to Mr. Slason, received from \$500 to \$10:

James Lewis, Shelton, Conn. (1909 Mitchell—218,734 miles); J. W. Norman, Paint Rock, Tex. (1909 Mitchell—183,837 miles); Sam Deck, Darlington, Ind. (1910 Mitchell—175,875 miles); J. D. Albright, Bowie, Tex. (1911 Ford—172,683 miles); Earl G. Druding, Ellsworth, Wis. (1909 Ford—171,418 miles); S. T. & E. R. R., Stockton, Cal. (1909 Mitchell—160,100 miles); Jacob Stark, Chciago, Ill. (1906 Logan—148,150 miles); J. J. Moore, Philadelphia, Penn. (1911 Ford—147,751 miles); John Fraser, Jr., Milwaukee, Wis. (1908 Buick—139,523 miles); George R. Mason, Des Moines, Ia. (1910 Maytag—135,000 miles); J. M. Bertolet, M. D., Reading, Penn. (1910 Mitchell—127,681 miles); James W. Hines, Minneapolis, Minn. (1910 Hudson—120,256 miles); Linus Liene, Buffalo, N. Y. (1910 Mitchell—120,000 miles); L. N. Burnette, Dallas, Tex. (1909 Flanders—116,557 miles); F. I. Wiltse,

Oneonta, N. Y. (1908 Ford—113,061 miles).

Cars that have gone more than 261,800 miles are very rare indeed, although a few cases have been reported in which mileage exceeding 300,000 miles has been accomplished. But in these cases almost without exception every running part has been renewed once or several times.

The contest, therefore, supplies a very remarkable demonstration of the capabilities for service in the ordinary standard car that is carefully driven and well taken care of. It is as much a triumph for the makers of the motor cars as it is for the Hyatt company. For the best of bearings if they were placed in a car in which the weight they were required to carry was not adapted to their capacity or the construction was such that the pressures were evenly applied could make no such record.

It is noticeable that in practically every case the car was driven for most of its life by an owner who took personal care of it himself. This is a demonstration of the truth of the opinion held by most automobile men that a car in the hands of a capable owner is better taken care of than one driven by a hired chauffeur. The fact that chauffeurs were not represented is, however, no reflection on their work. It is probable that an owner who employed a chauffeur would in most cases prefer to sell his car after a season or two and buy a new one with more stylish body and equipment even if his old one was not worn out.

MAXWELLS TO RACE AGAIN.

The four Maxwell racing cars which contested in the leading racing events last year are being rebuilt under the direction of Eddie Rickenbacher, and will appear again this year in the principal races. They have been purchased by the Prest-O-Lite Company of

Indianapolis, which is owned by the leading interests in the Indianapolis Speedway, and they will represent that company.

They will be painted red and white and will be narrower than last year and the driver and his mechanic will sit lower in them. The cars developed a speed of 105 miles an hour in 1915 and Rickenbacher, who will again be captain of the team, believes that this season at least five more miles an hour can be obtained from them.

The first event in which the cars will appear will be the Corona road race, March 17.

STUDEBAKER SERVICE CREW.

The Studebaker Corporation, which has been making a specialty of extraordinary service to motor car owners, is keeping a service crew on the down town streets of Detroit to look after the cars of men who are spending the evening in theatres, clubs or lodges. Twice every night the crew tours the district, examining every Studebaker car on the street. Service is given without charge to the owner.

If the motor is hard to start, as is likely on a cold night, it is warmed up. If the tires are low they are inflated, or if punctured, a new tube is put in them and the owner finds a note telling him about it and asking him to call for his old tube. If lights are weak the bulbs are renewed or the battery is changed and the owner is asked to call for his old one. If the motor is missing new spark plugs are put in and the engine is tuned up. If snow or rain began to fall after the owner left the car the top is put up. If the gasoline supply is too low a gallon is put in the tank. When the service men leave a car they put a tag on it telling just what service has been rendered. The idea is said to be liked by Studebaker owners.



1909 FORD 171,418 MILES

The 1908, 1909, 1910 and 1911 Cars which Won Prizes in this Remarkable Contest Are All Still in Use in the Hands of Their Owners.



1909 MITCHELL 218,734 MILES

CARS THAT MADE OVER 120,000 MILES ON ORIGINAL BEARINGS



1910 MITCHELL 127,681 MILES



1910 HUDSON 120,256 MILES



1908 BUICK 139,523 MILES

WILLYS DISCUSSES VALUES OF SMALL CARS.

SINCE the Willys-Overland company announced its small, light model 83, a great preference for that car over the heavier types has been evident at the Toledo plant. John N. Willys lays it to the fact that the light car is so much more economical in tires, gasoline and other expenses than the heavier car, and that compared with heavy car costs it will almost pay for itself in 50,000 miles. This matter of operating cost is of special importance this year when the price of gasoline is exceptionally high.

Cars whether light or heavy run about the same number of miles before they are finally worn out. Owing to its greater weight, the big machine requires larger tires. Comparing 34 by 4 tires for a larger car with 31 by 4 tires for a smaller, both of which are guaranteed for 5000 miles, nine new sets of either type would be required in 50,000 miles of driving. The difference in cost is approximately \$9 on each set, or a difference for 50,000 miles of \$81 in favor of the smaller machine.

The smaller car's economy in gasoline would figure out about as follows: The light type will average 20 miles on a gallon and the heavier one 10 or 15. In 50,000 miles the light car would use 2500 gallons of gasoline while the other is using 3400 gallons. The difference of 900 gallons, when figured as low as 22 cents each, amounts to a saving of \$198 by using the smaller machine.

The value of the larger car depreciates more with greater rapidity, and one that costs \$200 or \$300 more will seldom sell at \$50 over the price secured for the light car at the end of 50,000 miles.

URGES SAFETY FIRST CAMPAIGN.

A safety first campaign among owners and drivers to be conducted by automobile organizations and trade publications is urged by Hugh Chalmers, president of the Chalmers Motor Car Company, Detroit, to cut down the great number of accidents due to motor cars.

While, he says, 90 per cent. of the accidents are reported by the police to be due to the fault of the pedestrians, he believes that the hundreds of thousands of cars that are being turned out by makers will cause automobile accidents to increase greatly during the next few years unless great caution is exercised by drivers.

To forestall drastic laws against motorists, he urges that they all obey the traffic regulations and report the fact when other motorists break them. Mr. Chalmers declares that pedestrians, as well as drivers, should be under compulsion to obey the directions of traffic officers in crossing the streets.

WINTON REVERSES COLORS.

It has been the custom in painting limousines and other closed cars to make the upper half of the car black or some dark color and the lower part light. Dark colors are easier to put on evenly with good finish than

are light ones and as it is the habit of the human eye to observe carefully the upper half of any object, while the lower half is more or less taken for granted, painters have preferred to use the dark colors above.

There was a tradition in the trade, moreover, that the roof should be black and to put light colors on top would mean a more or less sharp contrast between the upper half sides of the car. But the Winton Company, Cleveland, which does all its painting by hand, has decided to reverse the color scheme and impart additional individuality to its product by placing the light color at the top.

MITCHELL LONG MILEAGE WINNER.

John W. Bate, chief engineer of the Mitchell-Lewis Motor Company, Racine, Wis., has reason to have great satisfaction over the outcome of the Hyatt Roller Bearing mileage contest, for among the 16 cars which made the largest mileage on Hyatt bearings were six Mitchell's—three of the 1909 model and three of 1910. They are all running today as well as ever.

THIS, THE GREATEST SALES YEAR.

That 1916 is to be by far the greatest year in the history of the automobile industry is the opinion of W. E. Stalnaker, vice president and director of sales of the Pathfinder Company, Indianapolis.

His first opinion was that the war would inevitably have the effect of limiting car sales, but the record-breaking sales at the New York and Chicago shows dispelled the last doubt as to the healthful condition of the market. Judging by the sales of his own country, Mr. Stalnaker is convinced that the epoch making year is at hand.

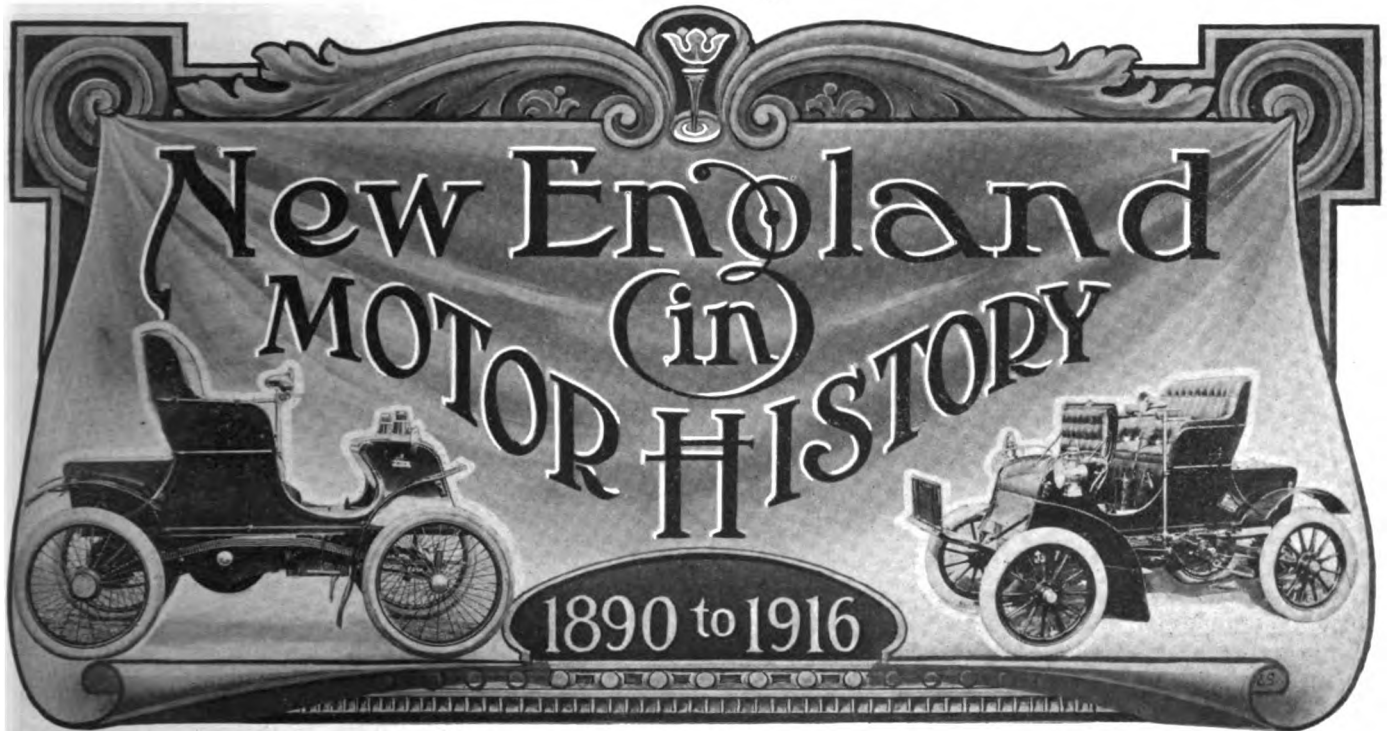
It was his opinion that there might be a lull after the two big shows, but none has come. There never has been a January when the orders continued to such an extent.

The mail is too slow for most dealers—they telegraph. One day recently 100 Pathfinder cars were ordered by a dealer in a western city who has seldom sold as many in an entire year. New York, Boston and Pittsburg agents also ordered in lots of 50.

Other makers, Mr. Stalnaker believes, are enjoying similar prosperity. Every one who has succeeded in building a good car at a reasonable price is moving his production rapidly.

The demand for Pathfinder cars has made it necessary to put a night force to work in the company's factory. Every effort was made to meet the sales demand without adopting that means, but none was found.

James H. Foster, final sales inspector of the Detroit Motor Car Company, who demonstrated the new Detroit at Minneapolis during the show there, declares the car attracted much attention by its performances, one of which was to climb a 25 per cent. grade in 18 below zero weather.



IT IS generally conceded that New England is the pioneer in the development of the motor vehicle industry. Within its boundaries much of the early experimental work was carried on by men who were either born or resided there, as is shown by irrefutable evidence.

A New Englander built the first practical motor vehicle to be publicly shown in operation in the United States. The first bona fide sale of a motor car was made in Massachusetts. A resident of that state was the first to equip a car with pneumatic tires, while another citizen was the first to use an engine starter that could be operated from the driver's seat. An inventor in Rhode Island designed and constructed America's first four-cylinder motor, while another New Englander produced the first practical American built six-cylinder motor car. And it was a resident of Providence, R. I., who designed and had manufactured the first strictly gasoline commercial vehicle on record.

New England's active participation in motor vehicle production dates back about 25 years, although scores of engineers in all parts of the section had been experimenting with internal combustion engines for road vehicles long before that time. In 1872 an engineer named Brayton invented and patented a two-cycle engine, but did not apply it to a vehicle. In 1879, George B. Selden applied for a patent on the idea of a road vehicle propelled by an internal combustion motor. This was granted in 1895 and had great influence on the later development of the industry, although eventually

the patent was disallowed by the courts.

In 1886 Charles E. Duryea of Springfield and Chicopee Falls, Mass., became interested in the internal combustion motor as the best means of propelling a road vehicle, and in 1891 actual work was begun on the first model of the Duryea motor wagon. This was the first motor vehicle shown in public and the first offered for sale in the United States, and it can be said that with it the automobile industry began. The machine was completed early in 1892.

Details of First Motor Vehicle.

The body was similar to that of a horse vehicle. The motor was a single-cylinder unit fitted with a governor. Changing speeds and steering were the only operations necessary. The vehicle was steered by a sidewise movement of the tiller, while the speed was regulated by an up and down movement. This was the original one hand control. Ignition was secured by electric spark, a great improvement over the hot tube ignition in the original Daimler engine made in

Europe. The wheels were of the horse vehicle type. Spiked iron tires were used to give traction on snow and ice.

J. Frank Duryea, Charles E. Duryea's brother, was connected with the building of the first car. In 1894 the men built another car which was much improved in many ways. It had pneumatic tires and is said to have been the first motor vehicle in the world so equipped. It had a two-cylinder opposed motor and a bevel gear transmission with three speeds forward and reverse. The car won



Three-Wheeled Knox Car of 1899, Price \$750, Without Equipment.



The Cameron Car of 1901 Which Had a Novel Engine Housing.

the Chicago Times Herald race in 1895 and was awarded the \$2000 prize.

First Sold in Boston.

Four of the Duryea machines were entered in the Cosmopolitan Magazine race from New York City to Irvington on the Hudson. Three of them made a successful return and won all the prizes, which amounted to \$3000. Several of the cars were marketed, one of the first being taken by George H. Morill of Norwood, Mass.

Morill was forced to hire a flagman to precede him when he drove down Boylston street, Boston. From this it would appear that if the car had great capabilities for speed they were not to be used in the city. P. A. Lewis, who opened the "Automobile Headquarters" on Stanhope street, Boston, about 1900, also owned one of the Duryea cars and exhibited it in several states at country fairs.

Pioneers Dissolve Business.

In 1897 the two Duryea brothers dissolved business connections, Frank becoming associated with the Stevens-Duryea Company, which for many years operated in Chicopee Falls, Mass., and Charles returning to their original home at Reading, Penn., where he continued his experiments.

The fourth model produced by him had a three-cylinder engine, a flywheel concentric with the crankshaft and a planetary transmission. It was a block motor, with water jackets over only the combustion chambers. The ignition was supplied by a magneto generator driven from the flywheel.

Another pioneer builder of motor cars was Max Hertel, whose machines later were constructed by the Oakman Motor Vehicle Company of Greenfield, Mass. He equipped his car with the first engine starter, and the judges of a contest in which he competed granted him \$100 for an "arrangement for starting the motor from the seat."

The machine had a two-cylinder motor of 3.625-inch bore and 4.75-inch stroke, and was rated at 2.5 horsepower. Each cylinder was fitted with a separate muffler, one of which supplied heat that was used to facilitate the vaporization of the gasoline. A small generator running at high speed furnished the ignition current.

The First Motor Starter.

The front wheels were of the bicycle type and were carried in forks. The fork on the right hand side extended above the body and was used as the post of the steering tiller. The starter consisted of a lever with a vertical motion. At the lower end of the lever was a

geared wheel which came into engagement with a gear attached to the crankshaft in such a way that when the lever was worked the engine was turned over.

L. F. N. Baldwin of Providence, R. I., built the first gasoline commercial vehicle on record. He undertook the task on a commission from John Shepard, Jr., who wanted it for delivery purposes for the Shepard company. The Cruikshank Engine Company of Providence executed the work.

First Commercial Vehicle Abandoned.

The vehicle was used for a time, but trouble was experienced with the carburetion and it was abandoned. The motor was a two-cylinder, four-cycle unit. There were two inlet and two exhaust valves for each cylinder. The wheels were fitted with plain steel tires, which made traction difficult under many conditions. The carbureting device was contained in the inlet valves and ignition was by hot tube.

About this time Kenneth A. Skinner of Boston had imported a De Dion motor tricycle and his efforts to interest American manufacturers in motor vehicles had great influence on the industry. He opened a salesroom at 122 Massachusetts avenue, Boston, and sold some of the machines. He later purchased a quadricycle attachment.

In these years much work was done in New England on motor bicycles which influenced the development of motor cars. The first motor tandem for pacing purposes was built by Rollin Abel of Boston and Dr. Charles G. Percival. With this the latter travelled about the country, breaking records and drawing immense crowds of people who there obtained their first sight of a motor vehicle. No carburetor was available for the small De Dion motor on the tandem. Instead, a half-filled gasoline tank was used and it was necessary to burn a newspaper under the tank each time the machine was used in order to heat the gasoline to release enough gas for the purposes of operating the motor tandem.

Steam Bicycles Produced.

A man named Whitney, who lived in East Boston, built a steam bicycle in 1894. Four years later Charles Roper of Newton, Mass., who had completed what perhaps was the first successful small steam motor designed in America, died of heart failure while driving the Columbia bicycle to which it was attached during



The First American Four-Cylinder Car Built in Pawtucket, R. I.



The Selden Vehicle on Which the Famous Patents Were Based.
a race on a track near Boston.

The Stanley pacing machine, which developed later into the Stanley steamer, was built in 1898. The Eclipse car was produced in Newton for one year. Frank Phelps of Pittsfield first built a car propelled by steam, and then turned to gasoline power, entering a car of that type in the 1903 Glidden tour. Grout Brothers of Orange, Mass., were successful manufacturers for several years and had representatives in many parts of the country. They made gas cars, turned to steam, and then reverted to gasoline as the source of power.

From 1894 to 1898 the General Electric Company engaged in experiments at its Lynn works under the direction of Prof. Elija Thomson, with electric and one-cylinder gasoline vehicles. These were built, but never marketed, the company finally entering the business by purchasing the Waltham Manufacturing Company, which was making the Orient Buckboard.

Kenneth A. Skinner, who has already been mentioned, and Henri Fournier, who had been connected with the De Dion company in Europe, had interested this company in the De Dion motor while it was making bicycles and the result had been a tandem for pacing purposes. Later Albert Champion and Dudley Marks arrived in America with an Aster motor and in this the Waltham people also became interested. Both types of motors were used in the Orient Buckboard, which later became famous as one of the first motor cars.

First Four-Cylinder Car.

The first four-cylinder car built in America is said to have been designed by Edward F. Scholze in Pawtucket, R. I. His first motor was a two-cylinder type, much like the De Dion, except that the cylinders were horizontal instead of vertical. Later he designed a four-cylinder engine. His drawings and material were purchased by John E. Blake of Attleboro, Mass., who was at that time interested with Frank Mossberg and some others in the United States Automobile Com-

pany. The car was completed in 1904.

The motor was virtually a combination of two two-cylinder motors which had one crankshaft. It was air cooled and of a four-cycle type. Provision was made for advancing the spark, which was an unusual feature at the time. Ignition was supplied by battery and was controlled by an ordinary electric light button on the dash.

It was driven to Newport, R. I., and to other places about the state, but was not regarded as being so successful as the electrics on which the company was working. It was finally traded to a jewelry buyer for 30 pieces of cut glass. He traded it for collar buttons. The last heard of it in Attleboro was that it had been attached by a steamship company because its owners failed to pay the charges for transportation.

The First Knox Car.

The first Knox car made by the Knox Automobile Company of Springfield, Mass., was marketed in 1889. It was a three-wheeled machine and was equipped with single cylinder, air cooled motor of 4.5-inch bore and six-inch stroke and rated at eight horsepower. This car design was continued until 1900. It had a tiller for steering purposes.

Isaac H. Davis of Dorchester, Mass., in 1899 organized the Crest Manufacturing Company of Cambridgeport, Mass., to manufacture gasoline automobiles. The first Crestmobile was a tricycle with a single cylinder, three horsepower, air cooled, vertical motor mounted in the rear. It appeared in 1899 and two years later it was equipped with four wire wheels and the motor was placed in front of the dash and the forward axle. A steering tiller was used.

The next year the company produced cars having air cooled motors under the floor boards. They were made in two sizes. Many were sold to physicians, the company emphasizing in its advertising the desirability of the machines for such service. Manufacture was discontinued in 1904.

E. S. and F. Cameron, who were engaged in the manufacture of bicycles at Brockton, Mass., built an air cooled car in 1901. It had no fan and the single cylinder engine projected from the small hood. A sliding gear transmission supplied two speeds forward and reverse. Drive was by bevel gears to the rear axle.

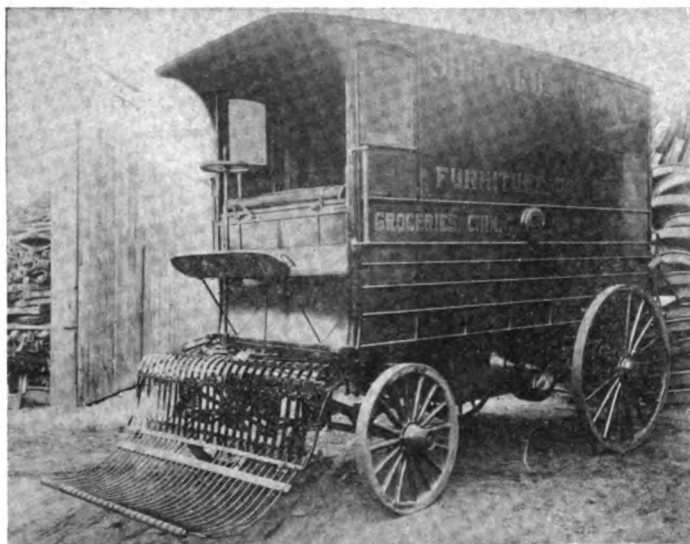


The Original Ford Car Which Upset the Patents.

The first American built six-cylinder car was also a New England production. Its design was based on the drawings of the English Napier company and operations were begun by the Napier Motor Car Company of America, which was located near Boston.

The product of this company was a practical six-cylinder car not greatly different than those made by a large number of companies until quite recently. This car was studied thoroughly by J. Frank Duryea of the Stevens-Duryea company, who then designed a new six, which was later produced by his company. This was the first real American six-cylinder motor car both designed and built in America.

Upon this evidence New England bases its claim as a pioneer in the motor vehicle industry. Twenty-five years have passed since the first Duryea machine was produced and now the bulk of manufacturing is being done in the middle west. But today the industry is still greatly influenced by New England, for even though its production of cars is relatively small,



The First Commercial Vehicle—Built in Providence.

it is one of the greatest markets for automobiles and commercial vehicles in the United States.

STUDEBAKER DEFERRED PAYMENT PLAN.

By an arrangement with the Commercial Investment Trust Company of New York and St. Louis, Studebaker dealers have been aided in financing sales of new cars to purchasers on a deferred payment basis. This plan is not intended to interfere with the local banking arrangements the dealers may have, but provides for more extensive facilities than the local banker would probably allow him. A sale can be made for part cash and part notes. The notes are then taken up by the investment concern, which assumes responsibility for their collection.

The Studebaker Corporation has no investment in the company and no connection with it, but has simply negotiated the scheme for the benefit of dealers. The plan is different from others in that the dealer on turning in notes does not get a credit from the factory, but actual cash. He is not compelled when selling cars on time to charge more than the actual list price.

PREDICTS HEAVY CAR SHORTAGE.

General Manager Scott of the Reo Motor Car Company, Lansing, Mich., predicts that owing to the raw material situation there will be a smaller number of cars made this year than last. He further declares that the great prosperity of the country will create a still larger demand and will bring about an acute shortage in cars and cause many increases in prices. He points out that several concerns have already found it necessary to raise prices.

Large scale producers who buy material in big lots, and have the financial ability and foresight to provide for their needs a year ahead, he points out are in a position where they will not suffer much from the competition of foreign war buyers because of the desire of the manufacturers of material to retain their future business. For producers not so fortunately placed the materials situation is rapidly becoming more serious.

PIERCE-ARROW'S GREATEST YEAR.

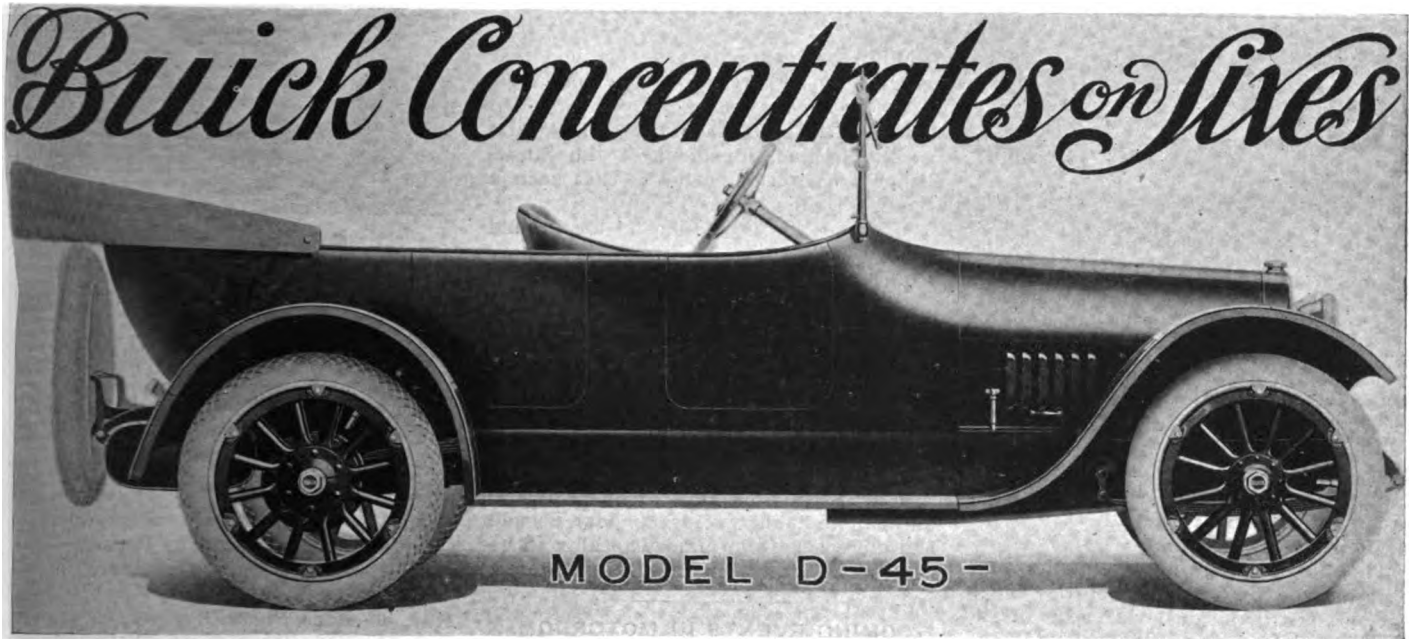
This is the 14th year that the Pierce-Arrow Company, Buffalo, N. Y., has been producing motor cars. The first car was a 2½-horsepower motorette with an imported motor and from that the car was developed through several forms to the Pierce-Arrow 66-horsepower six-cylinder of today. The same men who began the production of the first car are still with the company and are improving slightly every year on what they did before. The production has always been controlled by the producing heads, so that no outside pressure from stockholders could divert them from their ideals. The Pierce-Arrow tradition is now a great sale force. Many of the cars are bought on the name alone without inquiry into their details. The sales this year of both cars and trucks are greater than ever before in the history of the company.

OLDS WILL CONTINUE FOURS.

Reports that the Olds Motor Works, Lansing, Mich., might abandon its four-cylinder model and devote itself exclusively to the production of its new light eight are denied by officials of the company. As long as a demand for the four continues the manufacture of that car will be kept up. It is being found necessary, however, to turn a larger and larger portion of the great Olds plant, which is now one of the largest in the country, over to the production of the eight-cylinder model. The officials are convinced that the inherent advantages of the eight-cylinder design will make it the most popular high-grade car of the future and for that reason the company will stake its future on that type.

NEW MARMON BOOKLET.

"Supreme Passenger Comfort," by Forest Crissey, is the name of a new booklet issued by the Nordyke & Marmon Company, Indianapolis. It describes the testing trips through the Arizona deserts made by Howard Marmon.



SIXES exclusively are being built by the Buick Motor Company, Flint, Mich., during the 1916 season. They are made in two sizes, one selling for \$985 as a roadster and for \$1020 as a touring car, and one for \$1450 as a roadster and for \$1485 as a touring car. Both have the now famous Buick valve-in-the-head motor.

The smaller six, which naturally is made and sold in the greatest quantity, is not greatly different from the Buick model of similar size which was marketed last year, although it has refinements which improve the performance of the car and at the same time simplify and make more economical its manufacture, enabling the company to sell it for a lower price.

The unit power plant, of which the chief component is a four-cycle, six-cylinder, valve-in-the-head motor, is suspended at three points. The cylinders are made of semi-steel. The crankshaft has four main bearings with bronze backs and babbitt linings, the surfaces of which are exceptionally large. The valves are of tungsten steel, which has remarkable resistance to heat. The valve mechanism is exceedingly quiet. Noiseless ball end adjustable push rods work in ball and socket rocker arms in which a felt oil retainer is used. The motor

develops 45 horsepower. The bore is $3\frac{1}{4}$ and the stroke $4\frac{1}{2}$ inches.

Pump Water Circulation.

Water is circulated through the cooling system by a centrifugal pump bolted to the crank case. The water inlet and outlet manifolds are nickel plated. The radiator is a new cellular type of steel. The fan is of pressed steel and is driven from the camshaft pulley by a flat belt. The centre distances of the fan pulleys are easily adjusted to take up the expansion of the belt.

Jump spark ignition, which draws its current from a Delco electrical system, is employed. There is a combination hand and automatic spark advance. The carburetor is an automatic float feed type with a concentric float and is supplied by the auxiliary gravity feed vacuum system from a 16-gallon gasoline tank suspended from the rear end of the frame.

Self-contained constant level splash lubrication is employed. A distributing pipe is cast integral with the crank case. Oil is circulated by a gear pump and there is a special flush sight feed on the instrument board.

The clutch is an extra large leather

faced adjustable cone of aluminum, equipped with expanders under the leather to prevent harsh action. It is controlled by a brake which insures quiet, safe and easy gear shifting.

There are three speeds forward and reverse in the selective type sliding gear transmission. The transmission gears are of heat treated nickel steel. The clutch gear and sliding gear shaft run on a double row of annular ball bearings. The counter gear shafts run on bronze bearings.

Spiral Bevel Rear Axle.

Drive is direct to the spiral bevel gears in the rear axle. The nickel steel heat treated propeller shaft is fully enclosed and operates on ball bearings. The differential gears are of double heat treated nickel steel. A universal joint relieves all driving and torsional strains by means of a universal bearing of special Buick design, which is located on the front end of the third section.

Two sets of brakes, internal and external, operate on the rear wheel drums. They are effective and positive, but will not drag. They have been designed to avoid rattle and are easily adjustable.

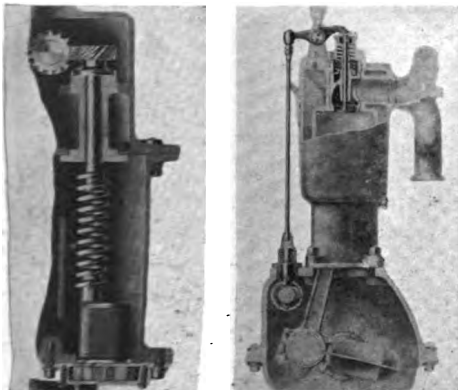
The full floating rear axle has a double row of ball bearings throughout. The driving pinion and the gear ring are of the spiral type, cut to Buick specifica-

BUICK FEATURES.

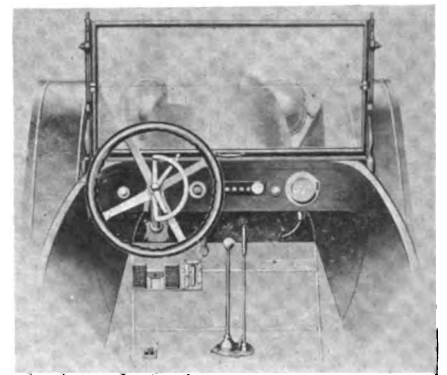
Make of Motor.....	Buick
Shape and Cast.....	I-En Bloc
Cylinders	Six
Bore and Stroke.....	$3\frac{1}{4} \times 4\frac{1}{2}$
S. A. E. Rating.....	25.35
Piston Displacement.....	224 cu. in.
Cooling System.....	Pump
Lubrication	Splash
Ignition.....	Delco, Single
Carburetor	Marvel
Starting-Lighting	Delco
Clutch	Cone
Gearset.....	Selective Three
Wheelbase	115
Wheels	Wood
Rear Springs.....	Cantilever
Steering and Control.....	Left, Centre
Rear Axle.....	Floating

Prices.

Touring, 5-Passenger.....	\$1020
Roadster, 2-Passenger.....	985



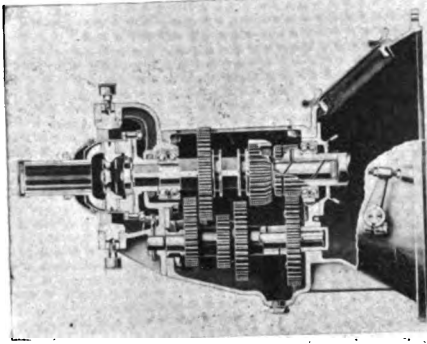
Cutaway Views of the Buick Valve Operating Mechanism (at Left) and the Oil Pump, Which Has Spring Drive and Oil Return.



Looking Into the Driver's Compartment of the Buick D-45, Showing How Instruments and Levers are Conveniently Arranged.

THE AUTOMOBILE JOURNAL.

TRAVEL BY AUTOMOBILE.



The Buick Gearset and Universal, Showing the Interlocking Device, Which Prevents Two Gears Being Locked Simultaneously.

tions to insure easy action and to eliminate friction as much as possible. Wheels are wood artillery type with 32 by four-inch tires.

The alloy steel springs are of the semi-elliptic type in front and of the Buick special floating cantilever type in the rear. The latter are 2½ inches wide and 46 inches long. The extra heavy frame is pressed steel with a 3½-inch drop and with exceptionally deep side members. The wheelbase is 115 inches and the tread is optional, either 56 or 60 inches.

The stream line body has a deep cowl and instrument board. The roadster has a delft blue body and hood and black chassis skirts and fenders. The wheels are vermilion with black stripes. The touring car has a blue black body and hood and black fender and chassis skirts. The deep cushions are upholstered in genuine leather over curled hair and springs. The running boards and floor boards are oil treated, linoleum covered and aluminum bound.

The larger Buick six-cylinder chassis is identical, except for dimensions. The motor is rated to develop 55 instead of 45 horsepower; the gasoline tank holds 25 instead of 16 gallons; the frame has a four-inch drop instead of 3½; the rear springs are three inches wide by 50 inches long; the wheels have extra large flanges with 12 oversize spokes; the tires are 36 by 4½, with non-skid on the rear; the wheelbase is 130 inches.

The color treatment of both the roadster and touring car consists of a royal green body and hood with a black stripe and black chassis skirts and fenders. The wheels on the roadster are natural wood color and on the touring car green. Exposed metal is nickel trimmed.

While it cannot yet be claimed that motor cars carry more people than their two chief competitors in self-propelled transportation, railroads and trolley cars, A. R. Erskine, president of the Studebaker Corporation, believes that such a time will soon come.

He bases his prediction on the ground that the automobile is a much more healthful, comfortable and enjoyable means of travel than the other two, while the increasing economy of motor car operation is making the cost more nearly equal.

Trains and trolleys follow beaten paths, and often passengers must travel in crowded cars and without privacy and in bad air. A large number must stand. These are some of the reasons why the automobile industry in the past decade has increased from almost nothing to be the fourth largest in the United States.

COMING EVENTS IN MOTORDOM.

February.

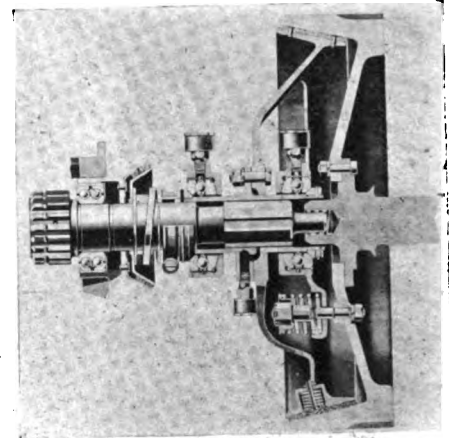
- Feb. 28-March 4—Convention, American Road Builders' Association, Pittsburg, Penn.
- Feb. 28-March 4—Show, Utica, N. Y.
- Feb. 28-March 4—Show, Indianapolis, Ind.
- Feb. 28-March 4—Show, Cedar Rapids, Ia.
- Feb. 28-March 4—Show, Paterson, N. J.
- Feb. 28-March 4—Show, Watertown, N. Y.
- Feb. 29-March 4—Show, Sioux City, Ia.
- Feb. 29-March 4—Show, Fort Dodge, Ia.

March.

- March 4-11—Show, Boston, Mass.
- March 5—Race, Los Angeles, Cal.; speedway.
- March 6-10—Convention, International Good Roads Congress, Montreal, Can.
- March 8-11—Show, Davenport, Ia.
- March 8-11—Show, Mason City, Ia.
- March 8-15—Show, Brooklyn, N. Y.
- March 9-11—Show, Kenosha, Wis.
- March 15-18—Show, Trenton, N. J.
- March 21-25—Show, Deadwood, S. D.
- March 22-25—Show, Saginaw, Mich.
- March 27-April 1—Show, Zanesville, O.
- March 28-April 3—Show, Manchester, N. H.

April.

- April 8—Race, Corona, Cal.
- April 10-15—Show, Seattle, Wash.



The Clutch of the Buick Is of a New Pattern.

- April 15—Convention, Pennsylvania Motor Federation, Altoona, Penn.
- April 26-May 6—Show, Oakland, Cal.

May.

- May 6—Race, Sioux City, Ia.; speedway.
- May 13—Race, New York City; Sheepsh-head Bay speedway.
- May 30—Race, Indianapolis, Ind.; speedway.
- May 31—Race, Minneapolis, Minn.; speedway.

June.

- June 10—Race, Chicago, Ill.; speedway.
- June 28—Race, Des Moines, Ia.; speedway.

July.

- July 2-6—Convention, World's Salesmanship Congress, Detroit, Mich.
- July 4—Race, Minneapolis, Minn.; 300-mile speedway.
- July 4—Race, Coeur D'Alene, Idaho.
- July 15—Race, Omaha, Neb.; speedway.

August.

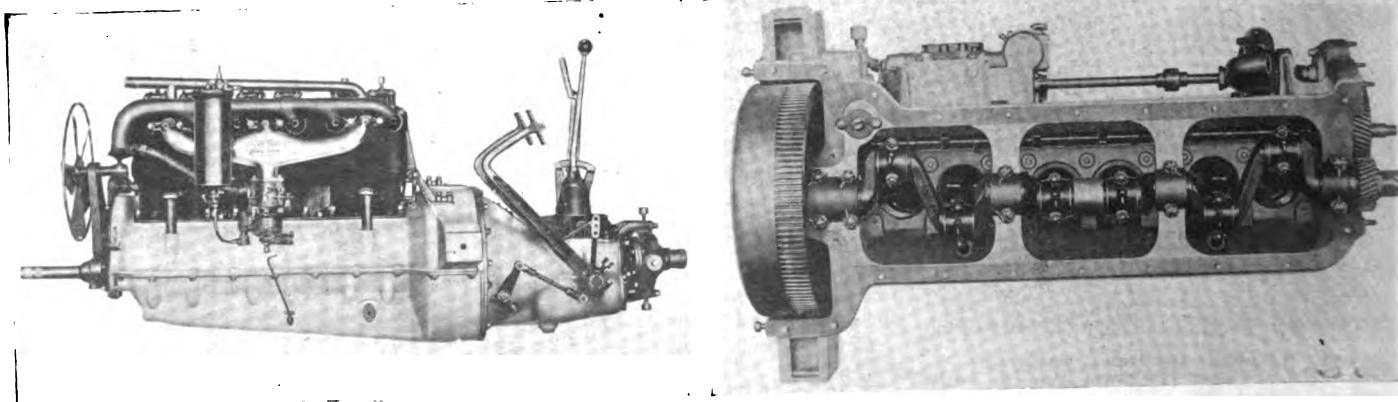
- Aug. 5—Race, Tacoma, Wash.; speedway.
- Aug. 18-19—Race, Elgin, Ill.; road.

September.

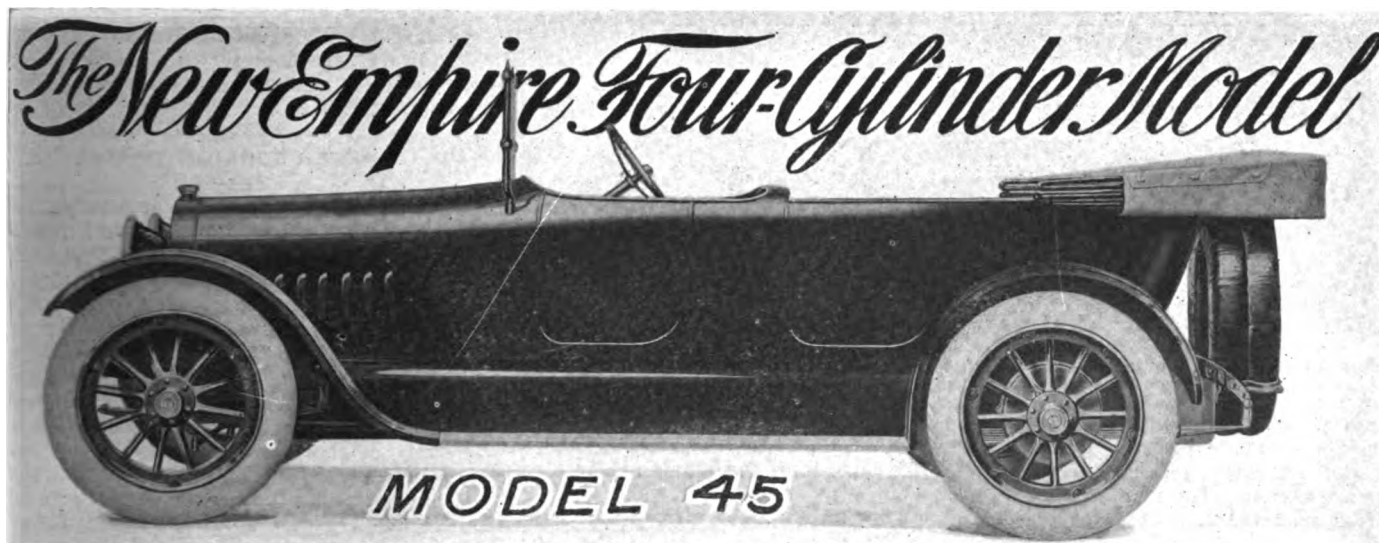
- Sept. 4—Race, Indianapolis, Ind.; speedway.
- Sept. 4—Race, Des Moines, Ia.; speedway.
- Sept. 16—Race, Providence, R. I.; speedway.
- Sept. 30—Race, New York City; Sheepsh-head Bay speedway.

October.

- Oct. 7—Race, Omaha, Neb.; speedway.
- Oct. 14—Race, Chicago, Ill.; speedway.
- Oct. 19—Race, Indianapolis, Ind.; speedway.



Carburetor Side of the Buick Valve-in-Head Six-Cylinder Motor (at Left); Looking Into Motor at the Four-Bearing Crankshaft.



MANY new features and refinements have been worked out in the Empire model 45, a new four-cylinder car, which is offered by the Empire Automobile Company of Indianapolis for \$935 during the 1916 season.

A very roomy body of exceptionally attractive lines is a feature, and the car has also a long wheelbase, improved rear spring suspension, new type of brakes and vacuum fuel feed. Throughout the construction great care has been taken to eliminate useless weight, with the result that the car is exceptionally high in efficiency and can be economically operated.

The body resembles closely that which has been adopted for the Empire six, and it has the double cowl type of construction. The color scheme is different from the usual blacks and greens. The standard color is autumn brown with Spanish leather upholstery to match.

A Teetor motor of T head design with four cylinders, 3 $\frac{3}{4}$ -inch bore and five-inch stroke, is employed. The intake manifold passes through the cylinder block and warms up the gas. The water heater is bolted to the cylinder casting. The pistons are cast from the same gray iron that is employed in the construction of the cylinder block and are fitted with three rings, one of which acts as a wiper.

Three-Bearing Crankshaft.

The connecting rods are forged and the

pin is carried on two bearings cast in the piston and rigidly attached to the rod. The crankshaft is a three-bearing type. The main bearings are babbit lined and bronze backed. The camshaft is built up with glass hard ground cams. It, too, has three bearings.

Timing gears are spiral cut; two are of cast iron and three of steel. The barrel type aluminum crank case is designed to afford the greatest rigidity to the crankshaft. The lower half may be removed, permitting easy access to the crankshaft and connecting rod bearings.

The lubrication is a special type of splash system. There are two overflow basins in the bottom of the crank case and at the bottom of these holes are drilled to admit a certain quantity of oil. There are the usual scoops on the lower ends of the connecting rods. Cast integral with the crank case are oil pockets which are located over the main bearings. These are at all times filled to overflowing and assure perfect lubrication of the bearings. The lower part of the crank case, outside of the basins mentioned, serves as an oil reservoir.

Ignition current is drawn from a battery, but is distributed through a magneto type distributor, with an automatic switch, which shuts off when the motor stops and so prevents the exhaustion of the battery. Fuel is fed by a vacuum system from a tank of 17 gallons capacity

and located at the rear. The tank is fitted with a gauge. A Schebler carburetor is employed and has hot air connections and an air control on the dash. The thermo-siphon cooling system is employed and the T type cylinders afford exceptionally large cooling space.

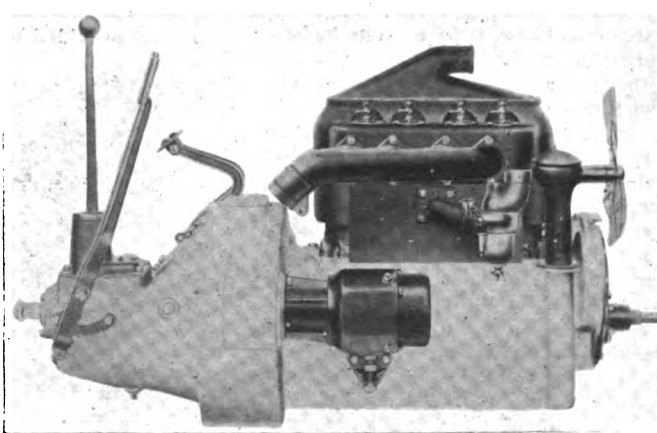
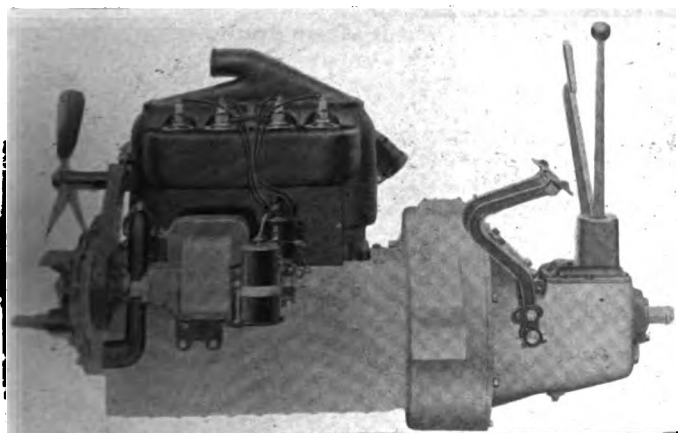
The radiator is a Fedders cellular type with expanding cells. The shell is a single piece of stamped steel shaped to conform with the other lines of the car. Protection is afforded by a pressed steel frame that extends from side to side of the frame. The fan is of pressed steel and has three blades. It is driven from the generator shaft by a belt. The cooling system has a capacity of 5 $\frac{1}{2}$ gallons.

Two-Unit Electrical System.

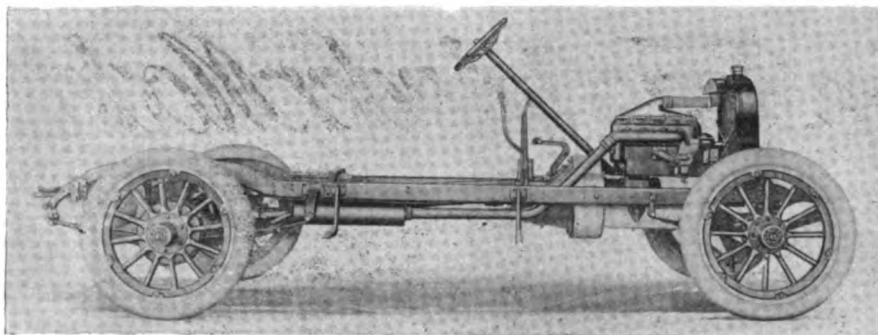
The Auto Lite two-unit electrical system, with generator mounted on the left side of the motor, and the starter act on a hardened flywheel ring through a Bendix drive connection.

A cone clutch has been adopted. It is 13 $\frac{3}{4}$ inches in diameter, with a two-inch face of selected chrome leather. Six bolts under the face of the clutch afford adjustment. A brake is also fitted.

The unit power plant type of assembly brings the transmission to the flywheel housing, where it is bolted rigidly. There are three speeds forward and reverse, with direct drive on high. The gears are extra heavy nickel steel, with rounded teeth to facilitate meshing. A ball and



Two Views of the Four-Cylinder T Head Teetor Motor Used in the New Empire Model 45—The Barrel Type Aluminum Crank Case Affords Maximum Rigidity.



Side View of the Empire Model 45 Chassis, Showing the Semi-Elliptic Spring Construction Which Has Been Adopted.

socket control, with a vertical lever, is employed. This lever acts directly upon the shifting forks and no intermediate rods are needed. The main transmission shaft is mounted on New Departure ball bearings, while the other shafts are on bronze bearings.

Hotchkiss rear drive through the springs is used. The rear axle is a Weston-Mott full floating, single bearing design. The live shafts are of chrome nickel steel. Hyatt high duty roller bearings are fitted throughout. The two sets of brakes, external and internal, operate through the equalizer system. The hand brake is attached to the equalizer through a flexible wire cable. The foot brake rod is made in two pieces, the first section connecting the pedal to a lever on the centre cross member with another rod from this lever to the equalizer. By this means a countershaft is made unnecessary and brake rod rattle is eliminated.

The wheelbase is 116 inches, which is four inches longer than the models of the previous year. The frame is of exceptionally sturdy construction, with a deep channel section of heavy gauged steel dropped slightly to lower the centre of gravity. A truss construction is employed at the rear and there are strong cross member supports for the rear extension of the frame, which carries the gasoline tank and the semi-elliptic springs. This is the first time that semi-elliptic rear springs have been employed in Empire construction, and as they are 52 inches long they produce a car of exceptionally easy riding qualities.

Semi-Elliptic Springs Employed.

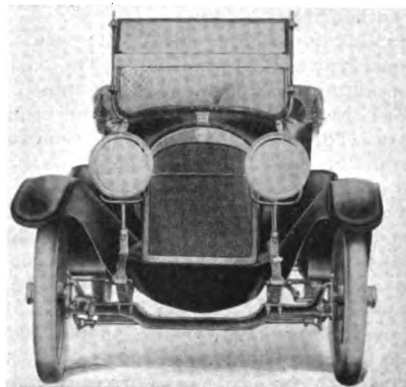
The front springs, of semi-elliptic type, are 37 inches long. The crowned fenders have a baked enamel finish. The oversized tire equipment is 33 by four inches, with non-skid in the rear.

The body is a modern streamline yacht type with convex rolled sides and double cowl. It is very similar to the Empire six. Exceptional leg room is permitted in both the driver's and the rear compartment. The front seat is 38 and the rear seat 47 inches wide. The deep cushions are built on tempered steel springs and are upholstered in genuine Spanish leather. Doors are of the full U type, 21 inches wide and have concealed hinges and handles.

The steering column is located at the left. A gear shift and hand brake lever is in the centre of the driving compartment. It is an oversize irreversible type, with full gear, allowing for numerous ad-

justments. The spark is controlled by a lever on top of the 17-inch steering wheel. The horn is of the motor driven electric type.

The head lamps are fitted with 15 candlepower bulbs and at the top are smaller bulbs for use as dimmer lights for city driving. The tail lamp is located on the rear fender and has a license bracket in combination. The dash lamp is placed on the instrument board. The tonneau is lighted by an individual lamp



Front View of the Empire 45, Which Has a Streamline Yacht Body.

set on the rear of the front seat. There is also an extension lamp for attachment in the dash socket. Throughout the lighting system armored cable is used and as a safeguard the entire system is protected by fuses located on the dash block.

The battery is a Willard three-cell, six-volt production; the five bow top of one-man type is covered with Dupont Raynite material and has storm curtains that can be operated from the inside. A tire carrier is provided to take two tires. De-

mountable rims and a rain vision ventilating type windshield are supplied. A Stewart speedometer is included. A power tire pump is furnished at an extra charge.

AFTER FOREIGN TRADE.

T. M. Kirker has been appointed special representative of the export department of the Chalmers Motor Car Company and has sailed for South America to do missionary work among South American buyers. In developing South American trade, Hugh Chalmers declares he is following the methods of those German firms which operated there so successfully before the war. He will make a study of the market by having his representative live among the people and find out what they want in motor cars. He believes that a few thousand dollars spent at this time in such preliminary work will be returned many times in the business that will be done after the war.

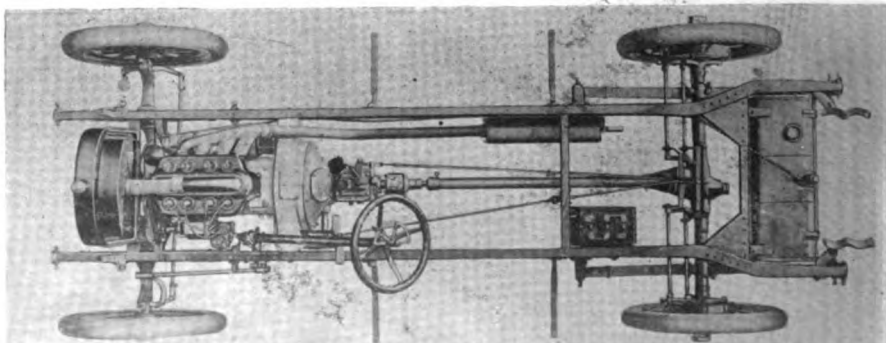
Among the important centres to be visited by the Chalmers representative on his first trip, which is to be of about six months' duration, are Rio de Janeiro, Montevideo, Buenos Aires, Santiago (Chile), Lima, Panama, Cartagena, Caracas, Porto Rico and Havana.

ACTRESS BUYS KING EIGHT.

Anita King, the moving picture actress, who recently attracted much notice by driving a car alone from the Pacific to the Atlantic coast, has chosen an eight-cylinder King roadster for her personal use. The deal was made by C. A. English of the English Motor Car Company, Southern California distributor of the King Eight, after Miss King had thoroughly examined the different cars on the market. She gave it many long, hard tests herself before making the choice.

MECHANISM DOESN'T SELL CARS.

No matter how perfect a car is mechanically these days, such perfection alone will not sell it, according to H. S. Daniels of the KisselKar company. It must have beauty of line and a pleasing finish. For that reason the Kissel Motor Car Company secures for its bodies the very finest quality of steel plates and carefully deoxidizes them so that the finish will adhere firmly.



The Wheelbase of the Empire Has Been Increased to 116 Inches—This View Shows the Exceptionally Sturdy Frame.

CHASSIS MODELS AND BODY STYLES FOR 1916.

Alphabetically Arranged List of the Various American Pleasure Cars with Index to Pages on Which Are Given the Technical Specifications.

ABBREVIATIONS—All y. c., all year car or all year coupe; All y. s., all year sedan; Ber., Berline; B'ham., brougham; B. lan., brougham-landau; Boul'v'd roadster, boulevard roadster; Cab'let, cabriolet; Chas. only, chassis only; C. lan., coupe landulet; Clov. l., cloverleaf; Cloverl'f, cloverleaf; Clov. road., cloverleaf roadster; Clubs'r., clubster; Con. sedan, convertible sedan; C. tour., closed touring; Demount., sedan, demountable sedan; Enc. drive, enclosed drive; Full f. d. lim., full four door limousine; Imp. lim., imperial limousine; Land., landulet; Lan. w. c. s., landulet with cab sides; L. b'ham., landulet brougham; Lim., limousine; Lim. c. s., limousine with cab sides; Lim.-land., limousine-landulet; L. road., landau roadster; M. C., motor coach; R. a. s., runabout with auxiliary seat; Rd. c'f, roadster, cloverleaf; Road., roadster; Road. det. coupe top, roadster with detachable coupe top; Run., runabout; Sal. phaet., salon phaeton; Sal. tour., salon touring; S. lan., suburban landau; Salon lim., salon limousine; Speed., speedster; S. phaeton, salon phaeton; Sub., suburban; T. c. w. w. t., touring car with winter top; T. c. s. t., touring with sedan top; Tour., touring; Tour. all. w. t., touring with all weather top; Tour. c. w. t., touring with winter top; Tour. d. s. t., touring with detachable sedan top; Tour. d. w. t., touring with detachable winter top; Tour. for. t., touring, foreign type; T. sedan, touring sedan; T. ton., toy tonneau; V. b., vestibule brougham; V. b. l., vestibule brougham-landulet; Vic. cab., victoria cabriolet; V. l., vestibule landau; V. lan., vestibule landulet; V. s., vestibule suburban; V. s. l., vestibule suburban landau; year r'd tour., year round touring.

Allen Motor Co., Fostoria, O.
Model and Body Cyl. Pas. PricePg.
Allen 37, touring..... 4 5 \$795 22
Allen, roadster..... 4 2 795 22

Alter Motor Car Co., Plymouth, Mich.
Model and Body Cyl. Pas. PricePg.
Alter C, touring..... 4 .. \$685 22

Anderson Motor Co., Rockhill, S. C.
Model and Body Cyl. Pas. PricePg.
Anderson 6-46, touring... 6 6 \$1250 26
Anderson 6-46, roadster... 6 4 1235 26
Anderson 6-46, raceabout 6 .. 1250 26

Apperson Bros. Auto Co., Kokomo, Ind.
Model and Body Cyl. Pas. PricePg.
Apperson 6-16, touring... 6 7 \$1550 26
Apperson 6-16, touring... 6 5 1485 26
Apperson 6-16, roadster... 6 4 1550 26
Apperson 8-16, touring... 8 7 1850 31
Apperson 8-16, roadster... 8 4 1850 31

Arbens Car Co., Chillicothe, O.
Model and Body Cyl. Pas. PricePg.
Arbens 25, touring..... 4 5 \$675 22

Argo Motor Co., Jackson, Mich.
Model and Body Cyl. Pas. PricePg.
Argo 1916, touring..... 4 5 \$495 22
Argo 1916, roadster*..... 4 2 445 22

*Roadster is driven through radius rod; touring car is driven through springs.

Auburn Automobile Co., Auburn, Ind.
Model and Body Cyl. Pas. PricePg.
Auburn Union, touring... 4 5 \$895 22
Auburn Union, roadster... 4 3 895 22
Auburn 4-38, touring... 4 5 985 22
Auburn 4-38, roadster... 4 3 985 22
Auburn 6-38, touring... 6 5 1050 26
Auburn 6-38, roadster... 6 3 1050 26
Auburn 6-40A, touring... 6 7 1375 26
Auburn 6-40A, roadster... 6 3 1375 26

Austin Automobile Co., Grand Rapids, Mich.
Model and Body Cyl. Pas. PricePg.
Austin 48-66, touring... 6 6 \$3600 26
Austin 36-66, roadster... 6 4 2800 26

Baker R. & L. Co., Cleveland, O.
Model and Body Cyl. Pas. PricePg.
Owen magnetic, touring... 6 4 \$3750 29
Owen magnetic, touring... 6 7 3750 29
Owen magnetic, roadster... 6 2 3750 29
Owen magnetic, lim.-land. 6 .. 5650 29
Owen magnetic, sedan... 6 .. 5150 29

Bayley Mfg. Co., Streator, Ill.
Model and Body Cyl. Pas. PricePg.
Halladay R, tour. & road. 6 5 \$1285 27
Halladay S, tour. & road. 6 5 1085 27
Halladay O, tour. & road. 6 7 2285 27
Roamer, spec. boat design 6 4 1800 30

Bartholomew Co., Peoria, Ill.
Model and Body Cyl. Pas. PricePg.
Glide 6-40, touring*..... 6 5 \$1095 27

*With runabout sedan top, \$1295.
Bell Motor Car Co., York, Penn.
Model and Body Cyl. Pas. PricePg.
Bell 16, touring..... 4 5 \$775 22
Bell 16, roadster..... 4 2 775 22

Biddle Motor Car Co., Philadelphia, Penn.
Model and Body Cyl. Pas. PricePg.
Biddle D, touring..... 4 4 \$1850 22
Biddle D, touring..... 4 5 1865 22
Biddle D, roadster..... 4 2 1800 22
Biddle D, town car..... 4 5 3000 22

Bimel Motor Co., Sidney, O.
Model and Body Cyl. Pas. PricePg.
Elco 30, touring..... 4 .. \$585 33
Elco 30 roadster..... 4 2 585 33

Brasie Motor Car Co., Minneapolis, Minn.
Model and Body Cyl. Pas. PricePg.
Packet, roadster..... 4 2 \$450 ..
Packet, roadster..... 4 4 450 ..

Brewster & Co., New York City.
Model and Body Cyl. Pas. PricePg.
Brewster, touring..... 4 4-5 \$6500 22
Brewster, landulet..... 4 4-5 7000 22
Brewster, brougham..... 4 4-5 6900 22
Brewster, enclosed drive. 4 4-5 7000 22
Brewster, runabout..... 4 2-3 6000 22

Special bodies to order with prices according to type.

Briscoe Motor Co., Jackson, Mich.
Model and Body Cyl. Pas. PricePg.
Briscoe Four, touring... 4 .. \$750 22
Briscoe Four, roadster... 4 .. 750 22
Briscoe Eight, touring... 8 .. 950 31
Briscoe Eight, roadster... 8 .. 950 31

Buckeye Mfg. Co., Anderson, Ind.
Model and Body Cyl. Pas. PricePg.
Lambert 76, touring 4 5 \$685 ..
Lambert 76, roadster... 4 2 685 ..

Buick Motor Co., Flint, Mich.
Model and Body Cyl. Pas. PricePg.
Buick D-45, touring..... 6 5 \$1020 26
Buick D-44, roadster... 6 2 985 26
Buick D-47, sedan..... 6 5 1875 ..
Buick D-46, coupe..... 6 3 1350 ..
Buick D-54, roadster... 6 2 1450 26
Buick D-55, touring..... 6 7 1485 26

Cadillac Motor Car Co., Detroit, Mich.
Model and Body Cyl. Pas. PricePg.
Cadillac 53, touring..... 8 7 \$2080 31
Cadillac 53, touring..... 8 5 2080 31
Cadillac 53, roadster... 8 2 2080 31
Cadillac 53, limousine... 8 7 2450 31
Cadillac 53, Berline..... 8 7 3600 31
Cadillac 53, Victoria... 8 3 2400 31
Cadillac 53, brougham... 8 5 2950 31
Cadillac 53, coupe..... 8 4 2800 31

Carter Motor Mfg. Co., Hannibal, Mo.
Model and Body Cyl. Pas. PricePg.
Brownie 41, touring..... 4 .. \$735 ..

J. L. Case T. M. Co., Racine, Wis.
Model and Body Cyl. Pas. PricePg.
Case T, touring..... 4 7 \$1090 22

Chadwick Engine Works, Pottstown, Penn.
Model and Body Cyl. Pas. PricePg.
Chadwick 19, touring.... 6 7 \$5500 27
Chadwick 19, roadster... 6 2 5500 27
Chadwick 19, limousine... 6 7 6500 27

Chalmers Motor Co., Detroit, Mich.
Model and Body Cyl. Pas. PricePg.
Chalmers 6-40, touring... 6 7 \$1350 27
Chalmers 6-40, roadster... 6 3 1350 27
Chalmers 6-40, Vic. cab... 6 .. 1450 27
Chalmers 6-40, Palanquin 6 .. 1700 27

Champion Auto Equip. Co., Wabash, Ind.
Model and Body Cyl. Pas. PricePg.
Champion body touring... 4 5 \$750 22
Champion, body roadster. 4 2 750 22

Chandler Motor Company, Cleveland, O.
Model and Body Cyl. Pas. PricePg.
Chandler 17, touring..... 6 7 \$1295 27
Chandler 17, roadster... 6 4 1295 27
Chandler 17, limousine... 6 7 2450 27
Chandler 17, coupe..... 6 4 1950 27
Chandler 17, sedan..... 6 5 2250 27
Chandler 17, con. sedan... 6 7 1795 27
Chandler 17, cabriolet... 6 3 1650 27
Chandler 17, tour. c. w. t. 6 7 1495 27

Chevrolet Motor Company, Flint, Mich.
Model and Body Cyl. Pas. PricePg.
Chevrolet H 2½, touring... 4 5 \$750 22
Chevrolet H 2½, roadster. 4 2 750 22
Chevrolet H 4, touring... 4 5 750 22
Chevrolet H 4, roadster... 4 2 750 22
Chevrolet, 490, touring... 4 5 490 22

Coe Motor Company, Chicago, Ill.
Model and Body Cyl. Pas. PricePg.
Coe, touring..... 4 5 \$650 22
Coe, roadster..... 4 2 650 22
Coe, runabout..... 4 2 650 22
Coe, roadster..... 4 2 425 22
Coe, runabout..... 4 2 425 22

Cole Motor Car Co., Indianapolis, Ind.
Model and Body Cyl. Pas. PricePg.
Cole 850, touring..... 8 7 \$1785 31
Cole 850, roadster..... 8 3 1785 31
Cole 850, Berline-limousine 8 3 3250 31
Cole 850, coupe..... 8 4 2185 31
Cole 850, demount. sedan. 8 7 2255 31

Commonwealth Motors Co., Chicago, Ill.
Model and Body Cyl. Pas. PricePg.
Partin-Palmer 20, run... 4 2 \$495 25
Partin-Palmer 32, tour... 4 5 675 25
Partin-Palmer 3-45, tour. 3 6 1195 32

Consolidated Car Company, Detroit, Mich.
Model and Body Cyl. Pas. PricePg.
Abbott-Detroit 8-30, tour. 8 7 \$1950 31
Abbott-Detroit 8-30, road. 8 2 1950 31
Abbott-Detroit 6-44, tour. 6 7 1195 26
Abbott-Detroit 6-44, road. 6 4 1250 26
Abbott-Detroit 6-44, speed. 6 2 1195 26
Abbott-Detroit 6-44, m. c. 6 4 1495 26
Abbott-Detroit 6-44, sedan 6 5 1795 26

Cortland Cart & Carriage Co., Sidney, N. Y.
Model and Body Cyl. Pas. PricePg.
Hatfield H, roadster..... 4 3 \$875 23
Hatfield I, suburban..... 4 5 844 23

Crawford Automobile Co., Hagerstown, Md.
Model and Body Cyl. Pas. PricePg.
Crawford 16-6-40, touring 6 .. \$1650 27
Crawford 16-6-40, roadster 6 .. 1650 27
Crawford 16-6-40, sedan... 6 .. 2000 27

Crow Motor Car Co., Elkhart, Ind.
Model and Body Cyl. Pas. PricePg.
Crow-Elkhart 30, touring 4 5 \$725 22
Crow-Elkhart 30, coupe... 4 3 995 22
Crow-Elkhart 30, sedan... 4 5 1095 22
Crow-Elkhart 33, cloverl'f 4 3 795 22
Crowther Motor Car Co., Rochester, N. Y.
Model and Body Cyl. Pas. PricePg.
Duryea 5-30, touring..... 4 5 \$650 ..
Duryea 5-30, touring..... 4 4 650 ..

Cummins Motor Co., Columbus, O.			
Model and Body	Cyl.	Pas.	Price Pg.
Monitor, touring.....	6	..	\$895 29
Monitor, roadster.....	6	..	895 29
Monitor, touring.....	4	..	795 24
Monitor, roadster.....	4	..	795 24

J. Cunningham Son & Co., Rochester, N. Y.			
Model and Body	Cyl.	Pas.	Price Pg.
Cunningham V, limousine	8	7	\$5000 31
Cunningham V, touring..	8	7	3750 31
Cunningham V, runabout.	8	7	3500 31

Daniels Motor Car Co., Reading, Penn.			
Model and Body	Cyl.	Pas.	Price Pg.
Daniels A, touring.....	8	7	\$2500 31
Daniels A, landaulet.....	8	7	3850 31
Daniels A, limousine.....	8	7	3700 31
Daniels A, roadster.....	8	2-3-4	2350 31
Daniels A, sedan.....	8	5	3500 31

G. W. Davis Motor Car Co., Richmond, Ind.			
Model and Body	Cyl.	Pas.	Price Pg.
Davis E, touring.....	6	7	\$1495 27
Davis 6-O, touring.....	6	5	1250 27
Davis 6-F, roadster.....	6	4	1250 27

DeKalb Mfg. Co., Auburn, Ind.			
Model and Body	Cyl.	Pas.	Price Pg.
DeKalb Junior.....	4	..	22

Detroit Motor Car Co., Detroit, Mich.			
Model and Body	Cyl.	Pas.	Price Pg.
Detroit F, touring.....	4	5	\$985 22
Detroit F, sedan.....	4	5	1150 22
Detroit F-45, touring.....	6	5	1098 27

Dispatch Motor Car Co., Indianapolis, Ind.			
Model and Body	Cyl.	Pas.	Price Pg.
Dispatch G, touring.....	4	5	\$1010* 23
Dispatch G, roadster.....	4	2	935* 23
Dispatch G, coupe.....	4	2	1300* 23

*Option equipment of electric starting and lighting costs \$200 extra.

Dixie Mfg. Co., Vincennes, Ind.			
Model and Body	Cyl.	Pas.	Price Pg.
Dixie Flyer 56, touring..	4	4	\$585 23
Dixie Flyer 56, roadster..	4	2	525 23
Dixie Flyer 36, roadster..	4	2	385 23

Dodge Bros., Detroit, Mich.			
Model and Body	Cyl.	Pas.	Price Pg.
Dodge Bros. M. C., touring	4	5	\$785 23
Dodge Bros. M. C., c. tour.	4	5	950 23
Dodge Bros. M. C., road..	4	2	785 23
Dodge Bros. M. C., c. road.	4	2	950 23

Dorris Motor Car Co., St. Louis, Mo.			
Model and Body	Cyl.	Pas.	Price Pg.
Dorris IA4, touring.....	4	7	\$2250 23
Dorris IA4, touring.....	4	5	2200 23
Dorris IA4, roadster.....	4	2	2200 23
Dorris IA4, limousine.....	4	7	3475 23
Dorris IA4, coupe.....	4	4	3000 23
Dorris IA6, touring.....	6	7	2475 27
Dorris IA6, roadster.....	6	2	2475 27
Dorris IA6, limousine.....	6	7	3675 27
Dorris IA6, coupe.....	6	4	3250 27

Dort Motor Car Co., Flint, Mich.			
Model and Body	Cyl.	Pas.	Price Pg.
Dort 5-A, touring.....	4	5	\$650 23

Drummond Motor Car Co., Omaha, Neb.			
Model and Body	Cyl.	Pas.	Price Pg.
Drummond Four, touring	4	..	\$1095 23
Drummond Four, roadster	4	..	1095 23
Drummond Four, runab't.	4	..	1095 23
Drummond Four, t. c. s. t.	4	..	1445 23

Dunn Motor Works, Ogdensburg, N. Y.			
Model and Body	Cyl.	Pas.	Price Pg.
Dunn Car, roadster.....	4	2	\$295 ..

Elgin Motor Car Corp., Chicago, Ill.			
Model and Body	Cyl.	Pas.	Price Pg.
Elgin, touring.....	6	5	\$845 27
Elgin, roadster.....	6	3	845 27

Elkhart Car. & Motor Co., Elkhart, Ind.			
Model and Body	Cyl.	Pas.	Price Pg.
Elcar 30-35, touring.....	4	5	\$795 23
Elcar 30-35, roadster.....	4	2	795 23

Empire Auto Co., Indianapolis, Ind.			
Model and Body	Cyl.	Pas.	Price Pg.
Empire 45, touring.....	4	5	\$935 23
Empire 60, touring.....	6	5	1095 27
Empire 60, tour., d. s. t.	6	5	1265 27

Enger Motor Car Co., Cincinnati, O.			
Model and Body	Cyl.	Pas.	Price Pg.
Enger Twin-6, touring.....	12	5	\$1095 33
Enger Twin-6, roadster..	12	3	1095 33

Farmack Motor Car Corp., Chicago, Ill.			
Model and Body	Cyl.	Pas.	Price Pg.
Farmack R, touring.....	4	5	\$855 23
Farmack B, roadster.....	4	2	855 23
Farmack S, cabriolet.....	4	2	1155 23

F. I. A. T., Poughkeepsie, N. Y.			
Model and Body	Cyl.	Pas.	Price Pg.
Fiat 55, landaulet.....	4	7	\$5950 23

Fiat 55, touring.....	4	7	4850 23
Fiat 55, touring.....	4	5	4850 23
Fiat 55, runabout.....	4	3	4850 23
Fiat 55, limousine.....	4	7	5850 23
Fiat 55, Berline.....	4	7	6100 23
Fiat 56, touring.....	6	7	5350 27
Fiat 56, runabout.....	6	3	5350 27
Fiat 56, limousine.....	6	7	6350 27
Fiat 56, Berline.....	6	7	6600 27
Fiat 56, landaulet.....	6	7	6450 27

Ford Motor Company, Detroit, Mich.			
Model and Body	Cyl.	Pas.	Price Pg.
Ford T, touring.....	4	5	\$440 23
Ford T, runabout.....	4	2	390 23
Ford T, coupelet.....	4	2	590 23
Ford T, sedan.....	4	5	740 23
Ford T, town car.....	4	6	640 23

Fostoria Light Car Co., Fostoria, O.			
Model and Body	Cyl.	Pas.	Price Pg.
Fostoria C, touring.....	4	5	\$675 23
Fostoria B, roadster.....	4	2	615 23
Fostoria G, speedster.....	4	2	495 23
Fostoria F, coupe.....	4	2	825 23

H. H. Franklin Mfg. Co., Syracuse, N. Y.			
Model and Body	Cyl.	Pas.	Price Pg.
Franklin 8, touring.....	6	5	\$1950 27
Franklin 8, roadster.....	6	3	1900 27
Franklin 8, Berline.....	6	7	3100 27
Franklin 8, coupe.....	6	3	2600 27
Franklin 8, sedan.....	6	5	2850 27
Franklin 8, brougham.....	6	5	2800 27

Gadabout Motor Corp., Detroit, Mich.			
Model and Body	Cyl.	Pas.	Price Pg.
Gadabout, runabout.....	4	..	\$385 ..

Grant Motor Company, Findlay, O.			
Model and Body	Cyl.	Pas.	Price Pg.
Grant V, touring.....	6	..	\$795 27
Grant V, roadster.....	6	..	795 27
Grant V, cabriolet.....	6	..	1025 27

Great Western Automobile Co., Peru, Ind.			
Model and Body	Cyl.	Pas.	Price Pg.
Great Western, touring..	6	5	\$1185 27

Haynes Automobile Co., Kokomo, Ind.			
Model and Body	Cyl.	Pas.	Price Pg.
Haynes 36, touring.....	6	5	\$1485 28
Haynes 36, roadster.....	6	3	1485 28
Haynes 37, touring.....	6	7	1585 28
Haynes 40, touring.....	12	5	1885 33
Haynes 40, roadster.....	12	3	1885 33
Haynes 41, touring.....	12	7	1985 33

Herff-Brooks Corp., Indianapolis, Ind.			
Model and Body	Cyl.	Pas.	Price Pg.
Herff-Brooks 4-35, tour..	4	5	\$885 23
Herff-Brooks 4-35, road.	4	2	885 23
Herff-Brooks 4-35, tour..	4	7	915 23
Herff-Brooks, H-6-50, tour.	6	5	1095 28
Herff-Brooks, H-6-50, road.	6	2	1095 28
Herff-Brooks, H-6-50, tour.	6	7	1125 28

Hudson Motor Car Company, Detroit, Mich.			
Model and Body	Cyl.	Pas.	Price Pg.
Hud. Super-Six, phaeton.	6	7	\$1375 28
Hud. Super-Six, roadster.	6	2	1375 28
Hud. Super-Six, cab'let..	6	3	1675 28
Hud. Super-Six, t. sedan.	6	7	1900 28
Hud. Super-Six, limousine	6	7	2500 28
Hud. Super-Six, town car	6	7	2500 28

Hupp Motor Car Corp., Detroit, Mich.			
Model and Body	Cyl.	Pas.	Price Pg.
Hupmobile, touring.....	4	7	\$1225 23
Hupmobile, touring.....	4	5	1085 23
Hupmobile, year r'd tour.	4	5	1185 23
Hupmobile, roadster.....	4	2	1085 23
Hupmobile, year r'd coupe	4	2	1165 23
Hupmobile, sedan.....	4	5	1365 23
Hupmobile, limousine.....	4	7	2365 23

Inter-State Motor Company, Muncie, Ind.			
Model and Body	Cyl.	Pas.	Price Pg.
Inter-State, touring.....	4	5	\$850 23
Inter-State, roadster.....	4	2	850 23
Inter-State, sedan.....	4	5	1050 23
Inter-State, sedan.....	4	2	1050 23

Jackson Automobile Co., Jackson, Mich.			
Model and Body	Cyl.	Pas.	Price Pg.
Jackson 34, touring.....	4	5	\$985 24
Jackson 34, tour., sed. top.	4	5	1195 24
Jackson 348, touring.....	8	5	1195 32
Jackson 348, tour., sed. t.	8	5	1405 32
Jackson 68, touring.....	8	7	1685 32
Jackson 68, tour., sed. top	8	7	1925 32

Thos. B. Jeffery Co., Kenosha, Wis.			
Model and Body	Cyl.	Pas.	Price Pg.
Jeffery 4, touring.....	4	7	\$1035 24
Jeffery 4, touring.....	4	5	1000 24
Jeffery 4, roadster.....	4	3	1000 24
Jeffery 4, sedan.....	4	5	1165 24
Jeffery 6, touring.....	6	7	1450 28

Kearns Mot. Truck Co., Beavertown, Penn.			
Model and Body	Cyl.	Pas.	Price Pg.
Kearns Kar L, touring....	4	5	\$650 24

King Motor Car Co., Detroit, Mich.			
Model and Body	Cyl.	Pas.	Price Pg.
King D, touring.....	8	5	\$1350 32
King D, roadster.....	8	3	1350 32

Kissel Motor Car Co., Hartford, Wis.			
Model and Body	Cyl.	Pas.	Price Pg.
KisselKar 4-32, touring..	4	5	\$1050 24
KisselKar 4-32, roadster.	4	4	1150 24
KisselKar 4-32, all y. c.	4	4	1450 24
KisselKar 4-32, roadster.	4	4	1450 24
KisselKar 6-42, touring..	6	5	1485 28
KisselKar 6-42, touring..	6	7	1585 28
KisselKar 6-42, roadster..	6	4	1650 28
KisselKar 6-42, limousine	6	7	2750 28
KisselKar 6-42, All y. c.	6	4	1950 28
KisselKar 6-42, all y. s.	6	5	2000 28
KisselKar 6-42, all y. s.	6	7	2100 28

Kline Car Corp., Richmond, Va.			
Model and Body	Cyl.	Pas.	Price Pg.
Kline Kar 6-36, touring..	6	5	\$1095 28
Kline Kar 6-36, roadster	6	2	1095 28

Lewis Spring & Axle Co., Chelsea, Mich.			
Model and Body	Cyl.	Pas.	Price Pg.
Hollier, touring.....	8	5	\$985 31

Lexington-Howard Co., Connersville, Ind.			
Model and Body	Cyl.	Pas.	Price Pg.
Lexington 4-KA, touring..	4	5	\$1375 ..
Lexington 60-LA, tour.*.	6	6	1875 28
Lexington 60-LA, clubs*r	6	3	1875 28

*With demountable sedan top, \$2175.

*With demountable coupe, \$2125.

Locomobile Co. of Amer., Bridgeport, Conn.			
Model and Body	Cyl.	Pas.	Price Pg.
Locomobile M6-48, tour..	6	7	\$5100 28
Locomobile M6-48, tour..	6	6	5100 28
Locomobile M6-48, lim..	6	7	6200 28
Locomobile M6-48, Berline	6	7	6500 28
Locomobile R6-38, tour..	6	6	4400 28
Locomobile R6-38, lim..	6	7	5400 28
Locomobile R6-38, Ber..	6	7	5700 28
Locomobile M6-48, land..	6	7	6300 28
Locomobile R6-38, land..	6	7	5500 28

The H. A. Lozier, Cleveland, O.			
Model and Body	Cyl.	Pas.	Price Pg.
H. A. L. 1, touring.....	12	7	\$2100 33
H. A. L. 1, roadster.....	12	3	2100 33

Lozier Motor Co., Detroit, Mich.			
Model and Body	Cyl.	Pas.	Price Pg.
Lozier 84, touring.....	4	7	\$1595 24
Lozier 84, limousine.....	4	5	3250 24
Lozier 84, cabriolet.....	4	3	2150 24
Lozier 84, roadster.....	4	2	1595 24
Lozier 82, touring.....	6	7	2775 24
Lozier 6-50, touring.....	6	7	1875 28
Lozier 82, limousine.....	6	7	4450 28
Lozier 6-50, roadster.....	6	7	1875 28

L. P. C. Motor Co., Racine, Wis.			
Model and Body	Cyl.	Pas.	Price Pg.
Lewis VI, touring.....	6	6	\$1390 28
Lewis VI, roadster.....	6	2	1390 28

Mercedes Automobile Co., Trenton, N. J.

Model and Body	Cyl.	Pas.	Price	Pg.
Mercedes 22-72, touring....	4	6	\$3000	24
Mercedes 22-72, raceabout....	4	2	2750	24
Mercedes 22-72, sporting....	4	4	3000	24
Mercedes 22-72 limousine....	4	7	....	24
Mercedes 22-72 runabout....	4	2	2900	24
Mercedes 22-72, town car....	4	7	....	24

Metz Company, Waltham, Mass.

Model and Body	Cyl.	Pas.	Price	Pg.
Metz 25, touring car....	4	5	\$600	24
Metz 25, roadster....	4	2	600	24

Mitchell-Lewis Motor Co., Racine, Wis.

Model and Body	Cyl.	Pas.	Price	Pg.
Mitchell 6 of '16, touring	6	5	\$1250	29
Mitchell 6 of '16, touring	6	7	1285	29
Mitchell 6 of '16, roadster	6	3	1250	29
Mitchell 8, touring.....	8	5	1450	32
Mitchell 8, touring.....	8	7	1450	32
Mitchell 8, roadster.....	8	3	1450	32

Moline Automobile Co., East Moline, Ill.

Model and Body	Cyl.	Pas.	Price	Pg.
Moline-Knight 50, touring	4	5	\$2500	24
Moline-Knight 50, road....	4	2	2500	24
Moline-Knight 50, lim....	4	..	3800	24
Moline-Knight 50, sedan....	4	5	3250	24
Moline-Knight 40, tour....	4	5	1375	24
Moline-Knight 40, road....	4	2	1375	24
Moline-Knight 40, clov. l.	4	4	1450	24
Moline-Knight, 40, tour....	4	7	1450	24

Monarch Motor Car Co., Detroit, Mich.

Model and Body	Cyl.	Pas.	Price	Pg.
Monarch, touring.....	8	7	\$1500	32

Monroe Motor Co., Flint, Mich.

Model and Body	Cyl.	Pas.	Price	Pg.
Monroe M-2, roadster....	4	2	\$495	24
Monroe M-2, runabout....	4	2	495	24

Moon Motor Car Co., St. Louis, Mo.

Model and Body	Cyl.	Pas.	Price	Pg.
Moon 6-30, touring.....	6	5	\$1195	29
Moon 6-30 roadster.....	6	3	1195	29
Moon 6-44 touring.....	6	7	1475	29
Moon 6-44, road. (club)....	6	4	1475	29
Moon 6-50, touring.....	6	7	2250	29

St. Pleasant Motor Co., Mt. Pleasant, Mich.

Model and Body	Cyl.	Pas.	Price	Pg.
M. P. M. 44, touring.....	8	5	\$1095	32
M. P. M. 44, roadster.....	8	4	1085	32

Mutual Motor Car Co., Buffalo, N. Y.

Model and Body	Cyl.	Pas.	Price	Pg.
Niagara C-16, touring....	4	5	\$740	24
Niagara C-16, roadster....	4	2	740	24

Mutual Motors Co., Jackson, Mich.

Model and Body	Cyl.	Pas.	Price	Pg.
Marion-Handley A, tour....	6	7	\$1185	29
Marion-Handley A, road....	6	4	1185	29
Marion K, touring.....	6	5	1090	29

*With detachable sedan top, \$1190.

National Motor Veh. Co., Indianapolis, Ind.

Model and Body	Cyl.	Pas.	Price	Pg.
National Highway, tour....	6	4	\$1690	29
National Highway, tour....	6	6	1720	29
National Highway, coupe....	6	4	2350	29
National Highway, sedan....	6	5	2900	29
National Newport 6 tour....	6	6	2500	29
National Newport 6, tour....	6	5	2375	29
National Newport 6, road....	6	3	2375	29
National Newport 6, t. ton....	6	4	2375	29
National Newport 6, coupe....	6	4	2350	29
National Newport 6, sedan....	6	5	3400	29
National High. 12, tour....	12	4	1990	33
National High. 12, tour....	12	6	2020	33
National High. 12, road....	12	3	1990	33
National High. 12, coupe....	12	4	2650	33
National High. 12, sedan....	12	5	3200	33

New Era Engineering Co., Joliet, Ill.

Model and Body	Cyl.	Pas.	Price	Pg.
New Era Simplicity, tour....	4	5	\$660	24

Nordyke & Marmon Co., Indianapolis, Ind.

Model and Body	Cyl.	Pas.	Price	Pg.
Marmon 34, touring.....	6	7	\$2750	29
Marmon 34, touring.....	6	5	2700	29
Marmon 34, c. roadster....	6	4	2700	29
Marmon 34, c. roadster....	6	3	2700	29

Norwalk M. Car Co., Martinsburg, W. Va.

Model and Body	Cyl.	Pas.	Price	Pg.
Norwalk D, roadster.....	6	2	\$2250	29
Norwalk D, touring.....	6	4	2250	29
Norwalk D, touring.....	6	6	2250	29
Norwalk C, roadster.....	6	2	2750	29
Norwalk C, touring.....	6	4	2750	29
Norwalk C, touring.....	6	6	2750	29

Oakland Motor Car Co., Pontiac, Mich.

Model and Body	Cyl.	Pas.	Price	Pg.
Oakland 38, touring.....	4	5	\$1050	24
Oakland 38, roadster.....	4	2	1050	24

Oakland 38, speedster....	4	2	1050	24
Oakland 32, touring.....	6	5	795	29
Oakland 32, roadster....	6	2	795	29
Oakland 50, touring.....	8	7	1585	32

Olds Motor Works, Lansing, Mich.

Model and Body	Cyl.	Pas.	Price	Pg.
Oldsmobile 43, touring....	4	5	\$1095	25
Oldsmobile 43, roadster....	4	2	1095	25
Oldsmobile 44, touring....	8	5	1195	32
Oldsmobile 44, roadster....	8	2	1195	32

Owen-Schoenbeck Co., Chicago, Ill.

Model and Body	Cyl.	Pas.	Price	Pg.
O-S, touring.....	6	6	\$2350	..
O-S, touring.....	6	4	2350	..
O-S, roadster.....	6	..	2350	..
O-S, runabout.....	6	..	2350	..
O-S, limousine.....	6	..	3250	..
O-S, toy tonneau.....	6	..	2350	..
O-S, road. det. coupe top....	6	..	2850	..
O-S, sedan.....	6	..	3000	..
O-S, town car.....	6	..	2850	..

Packard Motor Car Co., Detroit, Mich.

Model and Body	Cyl.	Pas.	Price	Pg.
Packard 1-35, touring.....	12	7	\$3150	33
Packard 1-35, sal. tour....	12	7	3150	33
Packard 1-35, sal. tour....	12	6	3150	33
Packard 1-35, phaeton....	12	6	3150	33
Packard 1-35, sal. phaet....	12	5	3150	33
Packard 1-35, imp. lim....	12	7	4800	33
Packard 1-35, salon lim....	12	7	4750	33
Packard 1-35, lim. c. s....	12	7	4650	33
Packard 1-35, land. c. s....	12	7	4650	33
Packard 1-35, lim. w. c. s....	12	6	4550	33
Packard 1-35, lan. w. c. s....	12	6	4550	33
Packard 1-35, brougham....	12	4	4600	33
Packard 1-35, chas. only....	12	..	2650	33
Packard 1-25, touring.....	12	7	2750	33
Packard 1-25, salon tour....	12	7	2750	33
Packard 1-25, phaeton....	12	5	2750	33
Packard 1-25, s. phaeton....	12	5	2750	33
Packard 1-25, runabout....	12	2	2750	33
Packard 1-25, limousine....	12	6	4150	33
Packard 1-25, landaulet....	12	6	4150	33
Packard 1-25, brougham....	12	4	4200	33
Packard 1-25, coupe.....	12	3	3700	33
Packard 1-25, chas. only....	12	..	2350	33

*Without cab sides, \$4600.

Paige-Detroit Motor Car Co., Detroit, Mich.

Model and Body	Cyl.	Pas.	Price	Pg.
Paige 6-38, touring.....	6	5	\$1095	29
Paige 6-46, touring.....	6	7	1295	29
Paige 6-46, tour. d. w. top....	6	7	1545	29
Paige 6-46, roadster.....	6	3	1295	29
Paige 6-46, coupe.....	6	3	1700	29
Paige 6-46, sedan.....	6	7	1900	29
Paige 6-46, town car.....	6	7	2250	29
Paige 6-46 cabriolet.....	6	3	1600	29

W. A. Paterson Co., Flint, Mich.

Model and Body	Cyl.	Pas.	Price	Pg.
Paterson 6-42, touring....	6	5	\$985	29
Paterson 6-42, touring....	6	7	1060	29

Pathfinder Co., Indianapolis, Ind.

Model and Body	Cyl.	Pas.	Price	Pg.
Pathfinder Fremont, tour....	6	7	\$1695	30
Pathfinder Fremont, tour....	6	5	1695	30
Pathfinder-Fremont, road....	6	4	1695	30
Pathfinder LaSalle, tour....	12	7	2475	33
Pathfinder LaSalle, rd. c'f....	12	3	2750	33

Peerless Motor Car Co., Cleveland, O.

Model and Body	Cyl.	Pas.	Price	Pg.
Peerless 56, touring.....	8	..	\$1890	32
Peerless 56, roadster.....	8	..	1890	32
Peerless 56, limousine....	8	..	3060	32

Pierce-Arrow M. Car Co., Buffalo, N. Y.

Model and Body	Cyl.	Pas.	Price	Pg.
Pierce-Arrow 66A4, tour....	6	7	\$6000	30
Pierce-Arrow 66A4, run*....	6	2	5900	30
Pierce-Arrow 66A4, tour....	6	4	5900	30
Pierce-Arrow 66A4, tour....	6	5	5900	30
Pierce-Arrow 66A4, sub....	6	..	7000	30
Pierce-Arrow 66A4, land....	6	..	7000	30
Pierce-Arrow 66A4 b'ham....	6	..	6800	30
Pierce-Arrow 66A4, s. lan....	6	..	7000	30
Pierce-Arrow 66A4, v. s....	6	..	7200	30
Pierce-Arrow 66A4, v. l....	6	..	7200	30
Pierce-Arrow 66A4, v. b....	6	..	6950	30
Pierce-Arrow 66A4, v. s. l....	6	..	7200	30
Pierce-Arrow 48B4, tour....	6	7	5000	30
Pierce-Arrow 48B4, run*....	6	2	4900	30
Pierce-Arrow 48B4, r. a. s....	6	3	4900	30
Pierce-Arrow 48B4, tour....	6	4	4900	30
Pierce-Arrow 48B4, tour....	6	5	4900	30
Pierce-Arrow 48B4, sub....	6	..	6000	30
Pierce-Arrow 48B4, land....	6	..	6000	30
Pierce-Arrow 48B4, b'ham....	6	..	5800	30
Pierce-Arrow 48B4, sub. l....	6	..	6000	30
Pierce-Arrow 48B4, v. s....	6	..	6200	30
Pierce-Arrow 48B4, v. lan....	6	..	6200	30
Pierce-Arrow 48B4, v. b....	6	..	5950	30

Pierce-Arrow 48B4, v. s. l....	6	..	6200	30
Pierce-Arrow 48B4, coupe....	6	..	5700	30
Pierce-Arrow 38C4, tour....	6	5	4300	30
Pierce-Arrow 38C4, run*....	6	2	4300	30
Pierce-Arrow 38C4, r. a. s....	6	3	4300	30
Pierce-Arrow 38C4, tour....	6	4	4300	30
Pierce-Arrow 38C4, b'ham....	6	..	5200	30
Pierce-Arrow 38C4, v. b....	6	..	5350	30
Pierce-Arrow 38C4, coupe....	6	..	5000	30
Pierce-Arrow 38C4, land....	6	..	5200	30
Pierce-Arrow 38C4, b. lan....	6	..	5200	30
Pierce-Arrow 38C4, sedan....	6	..	5200	30
Pierce-Arrow 38C4, v. b. l....	6	..	5350	30
Pierce-Arrow 38C4, v. lan....	6	..	5350	30

*With enclosed detachable top, \$6175.

*With enclosed detachable top, \$5175.

*With enclosed detachable top, \$4575.

Pilgrim Motor Car Co., Detroit, Mich.

Model and Body	Cyl.	Pas.	Price	Pg.
Pilgrim, touring.....	4	5	\$685	25

Pilliod Motor Car Co., Toledo, O.

Model and Body	Cyl.	Pas.	Price	Pg.
Pilliod F, touring.....	4	5	\$1435	25
Pilliod F, cloverleaf.....	4	4	1485	25
Pilliod F, roadster.....	4	2	1435	25

Pilot Motor Car Co., Richmond, Ind.

Model and Body	Cyl.	Pas.	Price	Pg.
Pilot 6-75, touring.....	6	7	\$2485	30
Pilot 6-75, touring.....	6	5	2400	30
Pilot 6-75, roadster.....	6	2	2400	30
Pilot 6-55, touring.....	6	5	1685	30
Pilot 6-55, touring.....	6	7	1735	30
Pilot 6-55, roadster.....	6	2	1685	30
Pilot 6-45, touring.....	6	5	1100	30
Pilot 6-45, roadster.....	6	4	1100	30
Pilot 8-55, touring.....	8	7	1835	32
Pilot 8-55, touring.....	8	5	1785	32
Pilot 8-55, runabout.....	8	2	1785	32

Pioneer Motor Car Co., Troy, N. Y.

Model and Body	Cyl.	Pas.	Price	Pg.
Harvard 4-20, roadster....	4	..	\$750	23
Harvard 4-20, coupe.....	4	..	850	23

Porter Co., F. R., Port Jefferson

Richard, roadster..... 4 2 3500 ..
Richard, limousine..... 4 7 4800 ..

Saxon Motor Co., Detroit, Mich.
Model and Body Cyl. Pas. Price Pg.
Saxon 147, roadster*..... 4 2 \$395 25
Model 157, roadster*..... 4 2 395 25
Saxon S-2, touring..... 6 5 785 30
Saxon S-2, tour., w. w. t. 6 5 935 30
Saxon S-2, roadster..... 6 3 785 30

†Model 14, is standard left hand drive car.

†Model 15 is same car with right hand drive and centre control used for export.

*With demountable top, \$455.

*With winter top, \$925

Scripps-Booth Co., Detroit, Mich.
Model and Body Cyl. Pas. Price Pg.
Scripps-Booth C, roadster 4 .. \$525 25
Scripps-Booth D, roadster 8 4 1175 32
Simplex Auto Co., Inc., N. Brunswick, N. J.
Model and Body Cyl. Pas. Price Pg.
Simplex 50, chassis only.. 4 .. \$4600 25
Simplex 33, chassis only.. 4 .. 4100 25
Simplex 46, chassis only. 6 .. 5000 30

Singer Motor Co., Inc., New York City.
Model and Body Cyl. Pas. Price Pg.
Singer, touring..... 6 7 \$3200 30
Singer, touring..... 6 4 3200 30
Singer, runabout..... 6 3 3200 30
Singer, limousine..... 6 7 4200 30
Singer, landaulet..... 6 .. 4250 30

S. J. R. Motor Co., Boston, Mass.
Model and Body Cyl. Pas. Price Pg.
S. J. R., boult'd roadster 4 3 \$855 25

Spaulding Mfg. Co., Grinnell, Ia.
Model and Body Cyl. Pas. Price Pg.
Spaulding H, touring..... 4 5 \$1250 25
Spaulding H, roadster.... 4 2 1250 25

Sphinx Motor Car Co., York, Penn.
Model and Body Cyl. Pas. Price Pg.
Sphinx B-16, touring..... 4 5 \$640 25

Standard Steel Car Co., Pittsburgh, Penn.
Model and Body Cyl. Pas. Price Pg.
Standard 6, touring..... 6 5 \$2100 30
Standard 6, runabout..... 6 3 2100 30
Standard 6, limousine..... 6 7 3600 30
Standard 8, touring..... 8 7 1735 32
Standard 8, roadster..... 8 3 1735 32

F. B. Stearns Co., Cleveland, O.
Model and Body Cyl. Pas. Price Pg.
Stearns-Knight L4, tour.. 4 5 \$1395 26
Stearns-Knight L4, road.. 4 2 1395 26
Stearns-Knight L4, lim... 4 7 2500 26
Stearns-Knight, coupe... 4 4 1900 26
Stearns-Knight, cabriolet 4 8 1000 26
Stearns-Knight, 6, touring 6 7 5000 30
Stearns-Knight 8, touring 8 7 2050 32
Stearns-Knight 8, road... 8 3 2050 32
Stearns-Knight 8, lim... 8 7 3350 32
Stearns-Knight 8, b'ham. 8 7 3300 32
Stearns-Knight 8, coupe. 8 4 2650 32
Stearns-Knight 8, c. lan.. 8 4 2650 32
Stearns-Knight 8, land... 8 7 3450 32
Stearns-Knight 8, l. b'ham. 8 7 3400 32

Sterling Auto Mfg. Co., New York City.
Model and Body Cyl. Pas. Price Pg.
Sterling-New York, tour.. 4 5 \$595 26
Sterling-New York, road.. 4 2 595 26

Stewart Motor Corp., Buffalo, N. Y.
Model and Body Cyl. Pas. Price Pg.
Stewart T, touring..... 6 7 \$1950 30
Stewart T, roadster..... 6 3 1950 30

Studebaker Corp., Detroit, Mich.
Model and Body Cyl. Pas. Price Pg.
Studebaker 4-40, touring 4 7 \$845 26
Studebaker 4-40, roadster 4 3 825 26
Studebaker 4-40, l. road.. 4 .. 1145 26
Studebaker 6-50, touring. 6 7 1050 31
Studebaker 6-50, roadster 6 3 1025 31
Studebaker 6-50, lim... 6 7 2500 31
Studebaker 6-50, coupe... 6 4 1600 31
Studebaker 6-50, l. road.. 6 3 1250 31
Studebaker 6-50, sedan... 6 7 1675 31

Stutz Motor Car Co., Indianapolis, Ind.
Model and Body Cyl. Pas. Price Pg.
Stutz C, touring..... 4 .. \$2300 26
Stutz C, roadster..... 4 .. 2100 26
Stutz C, bulldog special* 4 .. 2550 26
Stutz C, bearcat..... 4 .. 2000 26
Stutz C, bulldog†..... 4 4 2250 26

*Same technical specifications as other 130-inch chassis, except that direct drive ratio is 3.26-1, tires are 32x5 and wheels are wire.

†Same technical specifications as other

120-inch chassis, except that direct drive ratio is 3.06-1.

Sun Motor Car Co., Inc., Elkhart, Ind.
Model and Body Cyl. Pas. Price Pg.
Sun Lt. Six, touring..... 6 5 \$1095 31
Sun Lt. Six, roadster..... 6 4 1095 31

E. R. Thomas Motor Car Co., Buffalo, N. Y.
Model and Body Cyl. Pas. Price Pg.
Thomas MF, touring..... 6 .. \$4000 ..
Thomas MF, roadster..... 6 .. 3600 ..
Thomas MF, limousine... 6 .. 4800 ..
Thomas MF, Berline..... 6 .. 5000 ..
Thomas MF, coupe..... 6 .. 4500 ..
Thomas MF, sedan..... 6 .. 4800 ..

Times Square Auto Co., New York City.
Model and Body Cyl. Pas. Price Pg.
Mecca 30, touring..... 4 5 \$695 24
Mecca 30, roadster..... 4 2 695 24
Mecca 30, runabout..... 4 2 695 24

Trumbull Motor Car Co., Bridgeport, Conn.
Model and Body Cyl. Pas. Price Pg.
Trumbull 16-B, roadster.. 4 2 \$395 26
Trumbull 16-B, runabout 4 2 395 26
Trumbull 16-B, coupe.... 4 2 600 26

Velle Motor Vehicle Co., Moline, Ill.
Model and Body Cyl. Pas. Price Pg.
Velle 22, touring..... 6 5 \$1065 31
Velle 22, roadster..... 6 2 1045 31
Velle 22, coupe..... 6 .. 1750 31
Velle 15, touring..... 6 7 1450 31
Velle 15, touring..... 6 5 1400 31

Wayne Works, Richmond, Ind.
Model and Body Cyl. Pas. Price Pg.
Wayne-Rich'd 4-35, tour. 4 5 \$885 ..
Wayne-Rich'd 4-35, road. 4 2 885 ..
Wayne-Rich'd H-6-50, tour. 6 5-7 1095 ..
Wayne-Rich'd H-6-50, road. 6 2 1095 ..

Westcott Motor Car Co., Richmond, Ind.
Model and Body Cyl. Pas. Price Pg.
Westcott 51, touring..... 6 7 \$1595 31
Westcott 51, sedan..... 6 7 1945 31
Westcott 41, touring..... 6 5 1295 31
Westcott 41, roadster..... 6 3 1295 31
Westcott 41, cabriolet... 6 3 1595 31
Westcott 42, touring..... 6 5 1445 31
Westcott 42, roadster.... 6 3 1445 31
Westcott 42, cabriolet... 6 3 1745 31

Western Automobile Co., Seattle, Wash.
Model and Body Cyl. Pas. Price Pg.
Waco, touring..... 4 .. \$785 ..
Waco, roadster..... 4 .. 750 ..

The White Co., Cleveland, O.
Model and Body Cyl. Pas. Price Pg.
White GAH, touring..... 4 5 \$2700 26
White GAH, roadster.... 4 3 2650 26
White GAH, sedan..... 4 4 4000 26
White GAH, town car.... 4 6 4000 26
White GAH, town car lan. 4 6 4000 26
White GED, touring..... 4 7 3800 26
White GED, limousine... 4 7 5200 26
White GED, landaulet... 4 7 5200 26
White GED, semi tour... 4 7 5300 26

Willys-Overland Co., Toledo, O.
Model and Body Cyl. Pas. Price Pg.
Overland 75, touring..... 4 5 \$615 25
Overland 75, roadster.... 4 2 595 25
Overland 83B, touring*... 4 5 695 25
Overland 83B, roadster*.. 4 .. 675 25
Overland 86, touring..... 6 7 1145 29
Willys-Knight 84B, tour.. 4 5 1125 26
Willys-Knight 84B, road.. 4 2 1095 26
Willys-Knight 84B, lim... 4 7 1750 26
Willys-Knight 84B, coupe 4 4 1500 26

*With detachable top, \$895.

*With detachable top, \$825.

The Winton Company, Cleveland, O.
Model and Body Cyl. Pas. Price Pg.
Winton 22, touring..... 6 7 \$3500 31
Winton 22, touring..... 6 4 3500 31
Winton 22, roadster..... 6 2 3500 31
Winton 22, roadster..... 6 3 3500 31
Winton 22, % limousine. 6 7 4500 31
Winton 22, coupe..... 6 3 4500 31
Winton 22, sedan..... 6 6 4750 31
Winton 22, full f. d. lim. 6 7 4750 31
Winton 22, touring..... 6 6 3500 31
Winton 22, touring..... 6 5 3500 31
Winton 22, lim. landaulet 6 7 4750 31
Winton 22-A, touring..... 6 7 2335 31
Winton 22-A, touring..... 6 6 2435 31
Winton 22-A, touring..... 6 5 2285 31
Winton 22-A, touring..... 6 4 2285 31
Winton 22-A, roadster... 6 2 2285 31
Winton 22-A, roadster... 6 3 2285 31
Winton 22-A % limousine 6 7 3250 31
Winton 22-A, coupe..... 6 3 3200 31
Winton 22-A, sedan..... 6 6 3500 31
Winton 22-A, full f. d. lim. 6 7 3500 31
Winton 22-A, lim. land.. 6 7 3500 31

Zimmerman Mfg. Co., Auburn, Ind.
Model and Body Cyl. Pas. Price Pg.
Zimmerman, touring..... 6 .. \$1750 ..

ELECTRIC PLEASURE CAR MODELS.

Complete List of Chassis and Body Styles and their Prices
With Index to Technical Specifications.

Anderson Electric Car Co., Detroit, Mich.

Model and Body Pas. Price Pg.
Detroit Electric 56, cabriolet 3 \$2075* 33
Detroit Electric 57, broug... 4 2175* 33
Detroit Electric 58, brg. f. d. 5 2250* 33
Detroit Electric 59, brg. r. d. 5 2225* 33
Detroit Electric 60, brg. d. d. 5 2275* 33

*Edison battery \$880 extra on all models.

Bailey & Co., S. R., Amesbury, Mass.
Model and Body Pas. Price Pg.
Bailey roadster..... 2 2900* 33
Bailey roadster..... 4 3300* 33

*Price includes Edison battery and is the same irrespective of standard wheel-base lengths.

Baker R. & L. Co., Cleveland, O.
Model and Body Pas. Price Pg.
Baker R & L roadster.... \$2600* 33
Baker R & L club roadster .. 2800* 33
Baker R & L brougham... 2800* 33
Baker R & L town car.... 4000* 33
Baker R & L coach..... 3000* 33
Baker R & L coupe..... 2475* 33

*Price is the same for this style of body on all chassis.

Century Mfg. Co., Detroit, Mich.
Model and Body Pas. Price Pg.
Century LB, brougham.... \$2500* 33

*Without battery.

Eagle Electric Auto. Co., Detroit, Mich.
Model and Body Pas. Price Pg.
Eagle coupelet..... 3 \$1100* 33

Eagle limousine..... 5 1325* 33

*Without battery.

Fritchle Auto. & Battery Co., Denver, Col.
Model and Body Pas. Price Pg.
Fritchle, colonial brougham. 5 \$3600 33
Fritchle, colonial coupe.... 4 3200 33

Hupp-Yeats Electric Car Co., Detroit, Mich.
Model and Body Pas. Price Pg.
Hupp-Yeats 3, coupe..... 4 \$1500* 33
Hupp-Yeats 4, coupe..... 4 1750* 33
Hupp-Yeats 5, coupe..... 4 2000* 33

*Price includes electric charger.

Ohio Electric Car Co., Toledo, O.
Model and Body Pas. Price Pg.
Ohio 12, brougham..... 4 \$2400 33
Ohio 12, brougham..... 5 2900 33
Ohio 12, brougham..... 5 3250 33
Ohio 42, brougham..... 4 2400 33
Ohio 42, brougham..... 5 2900 33
Ohio 42, brougham..... 5 3250 33
Ohio 62, brougham..... 4 2400 33
Ohio 62, brougham..... 5 2900 33
Ohio 62, brougham..... 5 3250 33

Walker Vehicle Company, Chicago, Ill.
Model and Body Pas. Price Pg.
Walker 162, limousine, f. d.. 5 \$2275 33
Walker 163, brougham, r. d.. 4 2185 33
Walker 164, cabriolet road.. 4 1885 33

Woods Motor Vehicle Co., Chicago, Ill.*
*This company announces that it has disposed of its entire product of the 1916 series Woods electrics and that it will soon introduce its new Woods dual power electric.

ADDRESSES OF PLEASURE CAR MANUFACTURERS.

A Complete Record, Alphabetically Arranged By the Name of the Models, of the Gasoline and Electric Passenger Cars Being Produced in the United States for 1916.

Abbott-Detroit, Consolidated Car Co., Detroit, Mich.
Allen, Allen Motor Co., Fostoria, O.
Alter, Alter Motor Car Co., Plymouth, Mich.
Anderson, Anderson Motor Co., Rockhill, S. C.
Apperson, Apperson Brothers Auto Co., Kokomo, Ind.
Arbena, Arbena Car Co., Chillicothe, O.
Argo, Argo Motor Co., Jackson, Mich.
Auburn, Auburn Automobile Co., Auburn, Ind.
Austin, Austin Automobile Co., Grand Rapids, Mich.

Bailey Electric, S. R. Bailey & Co., Amesbury, Mass.
Baker R & L, Baker R & L Co., Cleveland, O.
Bell, Bell Motor Car Co., York, Penn.
Biddle, Biddle Motor Car Co., Philadelphia, Penn.
Brewster, Brewster & Co., New York City.
Briscoe, Briscoe Motor Co., Jackson, Mich.
Browale, Carter Motor Mfg. Co., Hannibal, Mo.
Buick, Buick Motor Co., Flint, Mich.

Cadillac, Cadillac Motor Car Co., Detroit, Mich.
Case, J. I. Case T. M. Co., Racine, Wis.
Century, Century Manufacturing Co., Detroit, Mich.
Chadwick, Chadwick Eng. Wks., Pottstown, Penn.
Chalmers, Chalmers Motor Co., Detroit, Mich.
Champion, Champion Auto Equipment Co., Wabash, Ind.
Chandler, Chandler Motor Co., Cleveland, O.
Chevrolet, Chevrolet Motor Co., Flint, Mich.
Coey, Coey Motor Co., Chicago, Ill.
Cole, Cole Motor Car Co., Indianapolis, Ind.
Crawford, Crawford Automobile Co., Hagerstown, Md.
Crow-Elkhart, Crow Motor Car Co., Elkhart, Ind.
Cunningham, Jas. Cunningham Son & Co., Rochester, N. Y.

Daniels, Daniels Motor Car Co., Reading, Penn.
Davis, George W. Davis Motor Car Co., Richmond, Ind.
DeKalb, DeKalb Manufacturing Co., Auburn, Ind.
Detroit Electric, Anderson Electric Car Co., Detroit, Mich.
Detroitter, Detroitter Motor Car Co., Detroit, Mich.
Dispatch, Dispatch Motor Car Co., Indianapolis, Ind.
Dixie Flyer, Dixie Mfg. Co., Vincennes, Ind.
Dodge Brothers, Dodge Bros., Detroit, Mich.
Dorris, Dorris Motor Car Co., St. Louis, Mo.
Dort, Dort Motor Car Co., Flint, Mich.
Drummond, Drummond Motor Car Co., Omaha, Neb.
Dunn Car, Dunn Motor Works, Ogdensburg, N. Y.
Duryea, Crowther Motor Car Co., Rochester, N. Y.

Eagle, Eagle Electric Automobile Co., Detroit, Mich.
Elcar, Elkhart Carriage & Motor Car Co., Elkhart, Ind.
Elco, Elco Motor Co., Sidney, O.
Elgin, Elgin Motor Car Corp., Chicago, Ill.
Empire, Empire Auto Co., Indianapolis, Ind.
Eger, Enger Motor Car Co., Cincinnati, O.

Farmack, Farmack Motor Car Corp., Chicago, Ill.
Fiat, F. I. A. T., Poughkeepsie, N. Y.
Fritchle, Fritchle Automobile & Battery Co., Denver, Col.
F. R. P., Finley Robertson Porter Co., Port Jefferson, N. Y.
Ford, Ford Motor Co., Detroit, Mich.
Fostoria, Fostoria Light Car Co., Fostoria, O.
Franklin, H. H. Franklin Mfg. Co., Syracuse, N. Y.

Gadabout, Gadabout Motor Corp., Detroit, Mich.
Gilde, Barthlomew Co., Peoria, Ill.
Grant, Grant Motor Co., Findlay, O.
Great Western, Great Western Auto. Co., Peru, Ind.

H. A. L., The H. A. Lozier, Cleveland, O.
Halliday, Barley Mfg. Co., Streator, Ill.
Harvard, Pioneer Motor Car Co., Troy, N. Y.
Hatfield, Cortland Cart and Carriage Co., Sidney, N. Y.
Haynes, Haynes Automobile Co., Kokomo, Ind.
Herr-Brooks, Herr-Brooks Corp., Indianapolis, Ind.
Hollier, Lewis Spring and Axle Co., Chelsea, Mich.
Hudson, Hudson Motor Car Co., Detroit, Mich.
Hupmobile, Hupp Motor Car Corporation, Detroit, Mich.
Hupp-Yeats, Hupp-Yeats Electric Car Co., Detroit, Mich.

Inter-State, Inter-State Motor Co., Muncie, Ind.

Jackson, Jackson Automobile Co., Jackson, Mich.
Jeffery, Thos. B. Jeffery Co., Kenosha, Wis.

KearnsKar, Kearns Motor Truck Co., Beavertown, Penn.
King, King Motor Car Co., Detroit, Mich.
KisselKar, Kissel Motor Car Co., Hartford, Wis.
KlineKar, Kline Car Corp., Richmond, Va.

Lambert, Buckeye Mfg. Co., Anderson, Ind.
Lewis Six, L. P. C. Motor Co., Racine, Wis.
Lexington, Lexington-Howard Co., Connersville, Ind.
Little Princess, Princess Motor Car Co., Detroit, Mich.
Locomobile, Locomobile Co. of America, Bridgeport, Conn.
Luverne, Luverne Automobile Co., Luverne, Minn.

Madison, The Madison Motors Co., Anderson, Ind.
Malcolm, Malcolm Motor Car Co., New York City.
Marion, Mutual Motors Co., Jackson, Mich.
Marion-Handley A., Mutual Motors Co., Jackson, Mich.
Marmon, Nordyke & Marmon Co., Indianapolis, Ind.
Maxwell, Maxwell Motor Co., Inc., Detroit, Mich.
McFarlan, McFarlan Motor Co., Connersville, Ind.
Mecca, Times Sq. Auto Co., New York City.
Mercer, Mercer Automobile Co., Trenton, N. J.
Metz, Metz Co., Waltham, Mass.
Mitchell Six '16, Mitchell-Lewis Motor Co., Racine, Wis.
Moline-Knight, Moline Automobile Co., East Moline, Ill.
Monarch, Monarch Motor Car Co., Detroit, Mich.
Monitor, Cummins Motor Co., Columbus, O.
Monroe, Monroe Motor Co., Flint, Mich.
Moon, Moon Motor Car Co., St. Louis, Mo.
M. P. M., Mt. Pleasant Motor Co., Mt. Pleasant, Mich.

National, National Motor Vehicle Co., Indianapolis, Ind.
New Era, New Era Engineering Co., Joliet, Ill.
Niagara, Mutual Motor Car Co., Buffalo, N. Y.
Norwalk, Norwalk Motor Car Co., Martinsburg, W. Va.

Oakland, Oakland Motor Car Co., Pontiac, Mich.
Ohio Electric, Ohio Electric Car Co., Toledo, O.
Oldsmobile, Olds Motor Works, Lansing, Mich.
O-S, Owen-Schoeneck Co., Chicago, Ill.
Overland, Willys-Overland Co., Toledo, O.
Owen Magnetic, Baker R & L Co., Cleveland, O.

Packard, Packard Motor Car Co., Detroit, Mich.
Packet, Brasie Motor Car Co., Minneapolis, Minn.
Paige, Paige-Detroit Motor Car Co., Detroit, Mich.
Partin-Palmer, Commonwealth Motors Co., Chicago, Ill.
Paterson, W. A. Paterson Co., Flint, Mich.
Pathfinder, Pathfinder Co., Indianapolis, Ind.
Peerless, Peerless Motor Car Co., Cleveland, O.
Pierce-Arrow, Pierce-Arrow Motor Car Co., Buffalo, N. Y.
Pilgrim, Pilgrim Motor Car Co., Detroit, Mich.
Pilliod, Pilliod Motor Car Co., Toledo, O.
Pilot, Pilot Motor Car Co., Richmond, Ind.
Premier, Premier Motor Mfg. Co., Indianapolis, Ind.
Pullman, Pullman Motor Car Co., York, Penn.

Regal, Regal Motor Car Co., Detroit, Mich.
Remington, Remington Motor Co., Kingston, N. Y.
Richard, Richard Auto Mfg. Co., Cleveland, O.
Reo, Reo Motor Car Co., Lansing, Mich.
Republic, Republic Motor Car Co., Hamilton, O.
Roamer, Barley Mfg. Co., Streator, Ill.

Saxon, Saxon Motor Co., Detroit, Mich.
Scripps-Booth, Scripps-Booth Co., Detroit, Mich.
Simplex, Simplex Auto Co., Inc., New Brunswick, N. J.
Singer, Singer Motor Co., Inc., New York City.
S. J. R., S. J. R. Motor Co., Boston, Mass.
Spaulding, Spaulding Mfg. Co., Grinnell, Ia.
Sphinx, Sphinx Motor Car Co., York, Penn.
Standard, Standard Steel Car Co., Pittsburg, Penn.
Stearns-Knight, F. B. Stearns Co., Cleveland, O.
Sterling, Sterling Auto. Mfg. Co., New York City.
Stewart, Stewart Motor Corp., Buffalo, N. Y.
Studebaker, Studebaker Corp., Detroit, Mich.
Stutz, Stutz Motor Car Co., Indianapolis, Ind.
Sun, Sun Motor Car Co., Inc., Elkhart, Ind.

Thomas, E. R. Thomas Motor Car Co., Buffalo, N. Y.
Trumbull, Trumbull Motor Car Co., Bridgeport, Conn.

Velle, Velle Motor Vehicle Co., Moline, Ill.

Waco, Western Automobile Co., Seattle, Wash.
Walker Electric, Walker Vehicle Co., Chicago, Ill.
Wayne-Richmond, Wayne Works, Richmond, Ind.
Westcott, Westcott Motor Car Co., Richmond, Ind.
White, The White Co., Cleveland, O.
Winton, The Winton Co., Cleveland, O.
Woods Electric, Woods Motor Vehicle Co., Chicago, Ill.

Zimmerman, Zimmerman Mfg. Co., Auburn, Ind.

SPECIFICATIONS OF 1916 FOUR-CYLINDER GASOLINE PLEASURE CARS.

For Full Information Regarding Prices, the Seating Capacities and the Various Body Styles, See the General Indexes.

Make	Alter	Arbans	Arge	Auburn	Auburn	Bell	Biddle	Brewster
Model	C	25	16	4-28	Union	A-16	D	Standard
Bore and Stroke	3.750x4.250	3.250x5.000	3.125x4.000	3.875x5.000	3.750x5.000	3.500x5.000	3.750x5.125	4.000x5.500
H. P., S. A. E.	22.50	16.90	15.83	24.03	22.5	19.60	22.50	25.60
Piston Dia., Cu. In.	220.9	165.9	127.7	235.8	220.9	192.4	226.4	276.5
Cyl., Type, Cast.	4-L-4	4-L-4	4-L-4	4-T-4	4-T-4	4-L-4	4-L-4	4-L-4
Make of Motor	Own	Lycoming	Perkins	Testor	Testor	Lycoming	Own	Own
Valve Location	Right	Left	Left	Opposite	Opposite	Right	Right	Chain
Camshaft Drive	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Chain
Cooling System	Ther.-Syp.	Ther.-Syp.	Ther.-Syp.	Pump	Pump	Ther.-Syp.	Ther.-Syp.	Pump
Lub. System	Spl. & F. F.	Spl. & F. F.	Spl. & F. F.	Spl. & F. F.	Spl. & F. F.	Spl. & F. F.	Spl. Pres.	Pressure
Oil Pump	Piston	Piston	Piston	Piston	Piston	Piston	Gear	Gear
Ignition System	Single	Single	Single	Single	Single	Single	Single	Single
Ignition, Control	West, hand	Conn., hand	Conn., hand	Remy, H. & A.	Conn.	At.-Kent, hand	Dixie mag.	Bosch, hand
Carburetor	Schebler	Gravety	Mayer	Rayfield	Rayfield	Carter	Special	Zen.-Brew.
Fuel Feed	Vacuum	Gravety	Gravety	Vacuum	Vacuum	Gravety	Vacuum	Vacuum
Starting System	West.	Apico	Disco	Remy	Remy	Disco	West.	U. S. L.
Lighting System	West.	Remy	Disco	Cone	Cone	Disco	West.	U. S. L.
Clutch	Cone	Cone	Cone	Cone	Cone	Cone	Plate	Cone
Gearset Type	S-Unit M	S-Unit M	Prog. amid.	S-Unit M	S-Unit M	S-Unit M	S-Unit M	Sel. amid.
Speed Ratios	Three	Three	Two	Three	Three	Three	Four	Three
Driven Through	Springs	Springs	Rad. Rod	Springs	Springs	Springs	Springs	Tor. tube
Rear Axle	Float.	Float.	1/2 float.	Float.	Float.	Float.	% float.	Float.
Direct Drive Rat.	4.00-1	4.25-1	4.25-1	4.00-1	4.00-1	4.00-1	4.00-1	3.92x1
Wheelbase	112	108	96	114	114	112	121	125
Tire Size	32x3 1/2, 32x3 1/2	30x3 1/2, 30x3 1/2	30x3 1/2, 30x3 1/2	34x4, 34x4	34x4, 34x4	31x4, 31x4	32x4	34x4 1/2, 34x4 1/2
Wheels	Wood	Wood	Wood	Wood	Wood	Wood	Wire	Wood
Rear Springs	1/2 elliptic	Cantilever	Elliptic	Cantilever	Cantilever	% elliptic	% elliptic	Cantilever
Drive and Control	Left, centre	Left, centre	Left, Centre	Left, centre	Left, centre	Left, centre	Left, centre	Right
Eng. Main Bear.	Plain, two	Plain, two	Plain, two	Plain, two	Plain, two	Plain	Plain, three	Plain
Gearset Bearings	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Ball
Rear Axle Bear.	Ball	Roller	Roller	B. & R.	B. & R.	Roller	B. & R.	Ball
Front Axle Bear.	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Roll

Make	Case	Champion	Chevrolet	Chevrolet	Coe	Crow Elkhart	DeKalb	Detroit
Model	T	Champion	4-90	Baby Grand H 4	C. F.	30	Junior	F
Bore and Stroke	3.625x6.000	3.687x4.000	3.687x4.000	3.750x4.250	3.250x5.000	3.500x5.000	3.750x4.250	3.750x4.250
H. P., S. A. E.	21.03	22.50	21.76	21.76	16.9	19.60	18	22.50
Piston Dia., Cu. In.	247.7	247.7	170.9	170.9	169	192.4	187.7	187.7
Cyl., Type, Cast.	4-L-4	4-L-4	4-I-4	4-I-4	4-L-4	4-L-4	4-L-4	4-L-4
Make of Motor	Model	G. B. S.	Own	Own	Lycoming	Lycoming	G. B. & S.	G. B. S.
Valve Location	Left	Right	Head	Head	Right	Right	Left	Left
Camshaft Drive	Helical	Helical	Helical	Helical	Helical	Helical	Gear	Chain
Cooling System	Ther.-Syp.	Ther.-Syp.	Ther.-Syp.	Ther.-Syp.	Ther.-Syp.	Ther.-Syp.	Ther.-Syp.	Ther.-Syp.
Lub. System	Spl. & pres.	Piston	Spl. & pres.	Spl. & pres.	Spl. & pres.	Spl. & pres.	Piston	Piston
Oil Pump	.....	.....	.....	.....	.....	.....	.....	.....
Ignition System	Single	Magneto	Single	Single	High mag.	Single	Magneto	Single
Ignition, Control	West, hand	West, hand	Sim., hand	Conn., hand	Conn.	Conn., hand	Split, Dixie	Split, hand
Carburetor	Rayfield	Rayfield	Zenith	Zenith	Carter	Zenith	Schebler	Schebler
Fuel Feed	Gravety	Gravety	Gravety	Pressure	Gravety	Gravety	Vacuum	Gravety
Starting System	Apico	Two unit	Auto-Lite	Auto-Lite	Disco	Dyneto 2 unit	Disco	Dyneto
Lighting System	West.	West.	West.	Auto-Lite	Disco	Dyneto 2 unit	Disco	Dyneto
Clutch	Cone	Cone	Cone	Cone	Cone	Disco	Disco	Disco
Gearset Type	S-Unit M	S-Unit M	S-Unit M	Sel. amid.	Selective	S-Unit X	Selective	S-Unit M
Speed Ratios	Three	Three	Three	Three	Three	Three	Three	Three
Driven Through	Springs	Springs	Springs	Springs	Tor. tube	Tor. tube	Springs	Springs
Rear Axle	% float.	% float.	% float.	% float.	% float.	Float	Float	Float
Direct Drive Rat.	4.08-1	4.23-1	3.67-1	4.00-1	4.37-1	4.25-1	4.25-1	4.00-1
Wheelbase	114	110	102	106	106	112	114	112
Tire Size	34x4, 34x4	32x3 1/2, 32x3 1/2	30x3 1/2, 30x3 1/2	32x3 1/2, 32x3 1/2	30x3 1/2, 30x3 1/2	30x3 1/2, 32x3 1/2	30x3 1/2, 30x3 1/2	33x4, 33x4
Wheels	Optional	Wood	Wood	Wood	Wood	Wood	Wood	Wood
Rear Springs	Cantilever	Cantilever	% elliptic	% elliptic	Cantilever	% elliptic	Cantilever	Plat.
Drive and Control	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre
Eng. Main Bear.	Plain three	Plain three	Plain three	Plain three	Plain three	Plain	Three	Plain three
Gearset Bearings	Plain	Roller	Ball	Ball	Roller	Roller	Roller	Ball
Rear Axle Bear.	B. & R.	Roller	Roller	Roller	Roller	Roller	Roller	Ball
Front Axle Bear.	Ball	Ball	Ball	Ball	Roller	Roller	Roller	Ball

[illegible]

ABBREVIATIONS—Cyls., Type, Casts, Cyls., total number; Type, shape of motor; Casts, pairs, four, six or eight. **Make of Motor:** Hersch-Spill., Hersch-Spillman; G. B. S., Golden, Becknap & Swarts; Rut. & Beav., Ruttenber & Beaver; Valve Locations: R. & H., Right and Head; Knight, Knight Sleeve Type; In V., In force feed. **Cooling Systems:** Ther.-Syp., Thermo-syphon. **Lubrication Systems:** Spl. pres., circulating pressure; Spl. & F., Splash and force feed. **Ignition Control:** Ig.-At.-Kent, Ignition, Conn., Connecticut; West., Westinghouse; At.-Kent, Atwater-Kent; Splitt., Splittorff; Control, H. & A., automatic. **Starting Systems:** West., Westinghouse; Aplo.-West., Bijur-Westinghouse; G. & D., Gray & Davis; Allis-Ch., Allis Chalmers; Stud. Wag., Studebaker Wagner; Leerce-N., Leerce-Neville. **Gearset Type:** S.-Unit M., Selective, unit with motor; Prog. Amdtl., Progressive amendment; S.-Unit X., Selective, unit with axle. **Driven Throughs:** Rad. Rod, Radius rod; Tor. tube, Torque tube. **Float Axle:** ½ float, semi-floating; float, floating. **Near Springs:** Plat., Platform. **Bearings:** R. & R., Ball and roller.

SPECIFICATIONS OF 1916 FOUR-CYLINDER GASOLINE PLEASURE CARS.

For Full Information Regarding Prices, the Seating Capacities and the Various Body Styles, See the General Indexes.

Make	Model	Jeffery	KearnsKar	KlaseKar	Lenox	Lozier	Maxwell	Mecca	Metzger
Jackson	34	3,750x5,250	2,750x4,000	4-32	3,875x5,500	4,250x6,500	3,625x4,500	3,750x4,250	22-72 Run
Bore and Stroke	3,500x5,000	22.50	12.10	28.90	28.90	28.00	21.03	22.50	3,750x6,750
H. P., S. A. E.	19.60	231.9	95.0	312.0	312.0	368.8	185.8	187.7	228.2
Piston Dia., Cu. In.	192.4	4-L-4	4 en bloc	4-L-4	4-L-4	4-L-4	4-L-4	4-L-4	4-L-4
Cyls., Type, Cast.	4-L-4	Own	.....	Own	Buda	Lozier	Own	G. B. & L	Own
Valve Location	Northway	Right	Side	Right	Right	Right	Right	Right	Right
Camshaft Drive	Helical	Helical	Spur	Helical	Helical	Chain	Helical	Chain	Chain
Cooling System	Pump	Pump	Ther.-Syp.	Pump	Pump	Pump	Ther.-Syp.	Pump	Pump
Lub. System	Spl. pres.	Spl. pres.	.....	Spl. pres.	Spl. pres.	Pressure	Spl. pres.	Pressure	Pressure
Oil Pump	Piston	Piston	.....	Gear	Gear	Gear	Piston	Gear	Gear
Ignition System	Single	Single	Single	Single	Single	Dup.	Single	Single	Single
Ignition, Control, Conn.	Bosch, hand	Bosch, hand	At.-Kent	West. H. & A.	West. H. & A.	Stewart	Split, hand	Bosch, hand	Bosch, hand
Carburetor	.....	Stromberg	Holley	Stromberg	Stromberg	Stewart	Schebler	Zenith	Zenith
Fuel Feed	.....	Vacuum	Gravity	Vacuum	Vacuum	Pressure	Vacuum	Vacuum	Vacuum
Starting System	Auto-Lite	Bijur	Disco	West.	West.	G. & D.	Sim. Huff	Disco	U. S. L.
Lighting System	Auto-Lite	Bijur	Disco	West.	West.	G. & D.	Sim. Huff	Disco	U. S. L.
Clutch	.....	Plate	Cone	Cone	Cone	Disc	Cone	Disc	Disc
Gearset Type	S-Unit M	S-Unit M	S-Unit M	Prog.-Unit X	Prog.-Unit X	S-Unit M	S-Unit M	S-Unit M	Sel. amld.
Speed Ratios	Three	Three	Three	Three	Three	Four	Three	Three	Four
Driven Through	Spring	Spring	Spring	Tor. tube	Tor. tube	Spring	Spring	Spring	Spring
Rear Axle	.....	1/2 float.	1/2 float.	1/2 float.	1/2 float.	Float.	1/2 float.	1/2 float.	Float.
Direct Drive Rat.	4.41-1	4.10-1	4.25-1	4.25-1	4.25-1	1.00-1	3.58-1	1.00-1	.....
Wheelbase	112	116	90	115	115	120	103	115	115
Tire Size	32x4, 32x4	34x4, 34x4	28x3, 28x3	33x4, 33x4	33x4, 33x4	36x4, 36x4	30x3, 30x3	32x4, 32x4	32x4, 32x4
Wheels	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood
Rear Springs	Elliptic	% elliptic	% elliptic	% elliptic	% elliptic	Plat.	% elliptic	% elliptic	% elliptic
Drive and Control	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre
Eng. Main Bear.	Plain three	Plain three	Plain three	Plain three	Plain three	Roller	Plain two	Plain	Plain three
Gearset Bearings	Ball	Roller	Ball	Ball	Ball	Roller	Roller	Roller	Ball
Rear Axle Bear.	B. & R.	Roller	Roller	Roller	Roller	Roller	Roller	Roller	B. & R.
Front Axle Bear.	Ball	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Ball

Make	Model	Moline-Knight	Moline-Knight	Monitor	Monroe	Morse	New Era	Niagara	Oakland
Mets	25	3,750x5,000	4,000x6,000	C. & R.	M-2	D	New Era	C-16	38
Bore and Stroke	3,875x4,000	22.50	25.60	3,750x4,250	3,062x3,750	4,625x5,000	3,125x4,500	3,125x4,500	3,500x5,000
H. P., S. A. E.	24.03	22.50	25.60	22.50	15.01	34.23	15.625	19.6	19.60
Piston Dia., Cu. In.	188.7	220.9	301.6	187.7	110.5	236.0	182.4	182.4	182.4
Cyls., Type, Cast.	4-L-4	4-Knl.-4	4-Knl.-4	4-L-4	4-I-4	4-I-4	4-L-4	4-L-4	4-L-4
Valve Location	Right	Own	Own	.....	.....	.....	.....	.....	.....
Camshaft Drive	Right	Chain	Chain	L. head	Head	Spur	Right	Right	Left
Cooling System	Ther. Syp.	Ther. Syp.	Ther. Syp.	Ther.-Syp.	Ther.-Syp.	Pump	Ther.-Syp.	Ther.-Syp.	Helical
Lub. System	Pressure	Pressure	Pressure	Spl. pressure	Spl. pressure	Spl. pressure	Spl. pressure	Spl. pressure	Pump
Oil Pump	Gear	Gear	Gear	Gear	Gear	Gear	Gear	Gear	Piston
Ignition System	Single	Single	Single	Single	Single	Dual	.....	.....	Dual
Ignition, Control	.....	.....	.....	.....	.....	.....	.....	.....	.....
Carburetor	.....	.....	.....	.....	.....	.....	.....	.....	.....
Fuel Feed	.....	.....	.....	.....	.....	.....	.....	.....	.....
Starting System	G. & D.	G. & D.	G. & D.	G. & D.	G. & D.	G. & D.	G. & D.	G. & D.	Delco H. & A.
Lighting System	G. & D.	G. & D.	G. & D.	G. & D.	G. & D.	G. & D.	G. & D.	G. & D.	Delco
Clutch	.....	.....	.....	.....	.....	.....	.....	.....	.....
Gearset Type	Friction	Friction	Friction	Friction	Friction	Friction	Friction	Friction	Friction
Speed Ratios	Seven	Seven	Seven	Seven	Seven	Seven	Seven	Seven	Seven
Driven Through	Frame	Frame	Frame	Frame	Frame	Frame	Frame	Frame	Frame
Rear Axle	.....	.....	.....	.....	.....	.....	.....	.....	.....
Direct Drive Rat.	Special	Special	Special	Special	Special	Special	Special	Special	Special
Wheelbase	108	118	128	108	96	127	104	112	112
Tire Size	32x3 1/2, 32x3 1/2	34x4, 34x4	36x4 1/2, 36x4 1/2	32x3 1/2, 32x3 1/2	30x3, 30x3	35x5, 35x5	30x3 1/2, 30x3 1/2	32x3 1/2, 32x3 1/2	33x4, 33x4
Wheels	Opt.	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood
Rear Springs	Elliptic	% elliptic	% elliptic	% elliptic	% elliptic	Elliptic	Elliptic	% elliptic	% elliptic
Drive and Control	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Right	Left, centre	Left	Left, centre
Eng. Main Bear.	Plain three	Plain three	Plain three	Plain three	Plain two	Ball	Plain five	Plain	Plain
Gearset Bearings	None	Ball	Ball	Ball	Ball	Ball	Hess-Bright	Roller	B. & R.
Rear Axle Bear.	Roller	B. & R.	B. & R.	B. & R.	B. & R.	Ball	Roller	Roller	Roller
Front Axle Bear.	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Ball

Make	Model	Overland	Overland	Partin-Palmer	Pillgrim	Pilliod	Palman	Regal
Oldsmobile	4-1-4	3,125x5,000	3,125x4,500	3,000x5,000	3,700x4,250	3,700x4,250	3,700x4,250	3,700x4,250
Bore and Stroke	3,125x5,000	3,125x4,500	3,125x4,500	3,000x5,000	3,700x4,250	3,700x4,250	3,700x4,250	3,700x4,250
H. P., S. A. E.	19.60	18.60	18.60	19.60	28	28	28	28
Platon Dia., Cu. In.	193.4	188.1	188.1	188.1	187.9	187.9	187.9	187.9
Cyls., Type, Cast.	4-1-4	4-1-4	4-1-4	4-1-4	4-1-4	4-1-4	4-1-4	4-1-4
Make of Motor	Northway	Own	Own	Lycoming	G.B. & S.	G.B. & S.	Own	Own
Valve Location	Head	Right	Right	Left	Chain	Chain	Chain	Chain
Cams	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Helical
Cooling System	Pump	Ther.-Syp.	Ther.-Syp.	Ther.-Syp.	Ther.-Syp.	Ther.-Syp.	Ther.-Syp.	Ther.-Syp.
Oil Pump	Splash	Splash	Splash	Splash	Spl. & F. F.	Spl. & F. F.	Spl. & F. F.	Spl. & F. F.
Ignition System	Piston	Gear	Gear	Gear	.....	.....	.....	.....
Ignition Control	Delco	Single	Single	Single	Magneto	Magneto	Magneto	Magneto
Carburetor	.....	Strom. & Tillot.	Strom. & Tillot.	Schebler	Zenith	Zenith	Zenith	Zenith
Fuel Feed	.....	Gravity	Gravity	Gravity	Vacuum	Vacuum	Vacuum	Vacuum
Starting System	Delco	Auto-Lite	Auto-Lite	Federal	Ward-L.	Pilliod spec.	Apico	Dyneto
Lighting System	Delco	Auto-Lite	Auto-Lite	Allis Ch.	Ward-L.	Pilliod spec.	Apico	Dyneto
Clutch	.....	Cone	Cone	Disc	Disc	Disc	Disc	Cone
Gearset Type	S-Unit M	S-Unit X	S-Unit X	S-Unit M	S-Unit M	S-Unit M	S-Unit M	Selective
Speed Ratios	.....	Three	Three	Three	Three	Three	Three	Three
Driven Through	Spring	Tor. tube	Tor. tube	Rad. Rod.	Float	Float	Float	Rad. rod
Rear Axle	.....	Float	Float	Float	Float	Float	Float	% float.
Direct Drive Rat.	4.42-1	4.33-1	4.33-1	4.00-1	4.00-1	4.00-1	4.00-1	4.00-1
Wheelbase	120	104	104	110	112	112	114	115
Tire Size	33x4, 33x4	33x4, 33x4	33x4, 33x4	32x3 1/2, 32x3 1/2	32x3 1/2, 32x3 1/2	32x3 1/2, 32x3 1/2	31x4, 31x4	33x4, 33x4
Wheels	.....	Wood	Wood	Wood	Wood	Wood	Wood	Wood
Rear Springs	.....	% elliptic	% elliptic	% elliptic	% elliptic	% elliptic	Cantilever	Cantilever
Drive and Control	Left centre	Left centre	Left centre	Left centre	Left centre	Left centre	Left centre	Left centre
Eng. Main Bear.	Plain	Plain two	Plain two	Plain two	Plain two	Plain two	Plain	Plain three
Gearset Bearings	B. & R.	Ball	Ball	Ball	Ball	Ball	Ball	Roller
Rear Axle Bear.	Roller	Roller	Roller	Ball	B. & R.	B. & R.	.....	Roller
Front Axle Bear.	Roller	Roller	Roller	Ball	Ball	Ball	Ball

Make	Model	Remington	Reo	Saxon	Simplex	S. J. R.	Spanning	Sphinx
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Bore and Stroke	3,500x4,000	4,125x4,500	4,125x4,500	3,000x4,250	5,375x6,500	4,250x5,500	4,250x5,500	3,250x5,000
H. P., S. A. E.	19.60	27.28	27.28	14.40	46.23	16.9	28.90	16.90
Platon Dia., Cu. In.	153.9	240.5	240.5	120.2	590.0	312.0	312.0	185.9
Cyls., Type, Cast.	4-1-4	4-1-4	4-1-4	4-1-4	4-1-4	4-1-4	4-1-4	4-1-4
Make of Motor	Port Huron	Own	Own	Sterling	Own	Own	Buda	.....
Valve Location	Left	R. & H.	R. & H.	L. & H.	Opposite	.....	Right	Side
Cams	Helical	Helical	Helical	Helical	Helical	.....	Helical	Spur
Cooling System	Ther.-Syp.	Ther.-Syp.	Ther.-Syp.	Ther.-Syp.	Pump	Ther.-Syp.	Pump	Ther.-Syp.
Oil Pump	Splash	Splash	Splash	Splash	Splash	Splash	Splash	Splash
Ignition System	Piston	Single	Single	Single	Gear	Gear	Piston	Single
Ignition Control	Delco	At.-Kent	At.-Kent	Single	Dual	Dual	Simms, hand	Conn. hand
Carburetor	.....	Remy, hand	Remy, hand	Remy	Bosch, hand	Bosch, hand	Rayfield	Mayer
Fuel Feed	.....	Johnson	Johnson	Zenith	Newcomb	Newcomb	Vacuum	Gravity
Starting System	Dyneto	Gravity	Gravity	Wagner	Rushmore	Rushmore	Ents	Apico
Lighting System	Dyneto	Remy	Remy	.....	Rushmore	Rushmore	Ents	Apico
Clutch	.....	Disc	Disc	Disc	Disc	Disc	Cone	Cone
Gearset Type	S-Unit M	S-Unit X	S-Unit X	S-Unit M	S-Unit M	S-Unit M	Three	Selective
Speed Ratios	.....	Three	Three	Three	Four	Three	Three	Three
Driven Through	Tor. tube	Tor. tube	Tor. tube	Sp. & Tor.	Tor. tube	Tor. tube	Springs	Springs
Rear Axle	.....	% float.	% float.	% float.	% float.	% float.	Float	% float.
Direct Drive Rat.	4.25-1	4.75-1	4.75-1	4.75-1	2.75-1	2.75-1	3.75-1	4.00-1
Wheelbase	106	110	110	110	137	108	120	112
Tire Size	30x3 1/2, 30x3 1/2	34x4, 34x4	34x4, 34x4	30x3 1/2, 30x3 1/2	36x4 1/2, 37x5	30x3 1/2, 30x3 1/2	36x4, 36x4	30x3 1/2, 30x3 1/2
Wheels	.....	Wood	Wood	Wire	Opt	Wire	Wood	Wood
Rear Springs	.....	% elliptic	% elliptic	Cantilever	% elliptic	Cantilever	% elliptic	Cantilever
Drive and Control	Left centre	Left centre	Left centre	Left centre	Right	Left centre	Left centre	.....
Eng. Main Bear.	Plain two	Plain three	Plain three	Plain two	Plain three	Plain	Plain	Two
Gearset Bearings	Roller	Roller	Roller	Ball	Ball	Ball	B. & R.	.....
Rear Axle Bear.	Roller	Roller	Roller	Ball	Ball	Ball	Roller	.....
Front Axle Bear.	Ball	Roller	Roller	Ball	Ball	Ball	Roller	.....

ABBREVIATIONS—Cyls., Type, shape of motor; Cast, pairs, fours, sixes or eights. Make of Motor: Hersch-Spill, Hersch-Spillman; G. B. S., Golden, Belknap & Swartz; Rut. Beav., Rutenber & Beav.; Valve Location: R. & H., Right and Head; Knight, Knight Sleeve Type; In V. in alley of an eight or 12. Cooling Systems: Ther.-Syp., Thermo-syphon. Lubrication System: Spl. pres., Splash and pressure; Cir. pres., circulating pressure; Spl. & F. F., Splash and force feed. Ignition Control: Ig-nition, Conn. Connecticut; West, Westinghouse; At.-Kent, Atwater-Kent; Split, Splitdorf; Control, H. & A., Hand and automatic; At. automatic, Starting System: West, Westinghouse; Apico, Apico; Bij.-West, Bijur-Westinghouse; G. & D., Gray & Davis; Allis-Ch., Allis Chalmers; Stud. Wag., Studebaker Wagner; Leece-N., Leece-Neville. Gearset Type: S-Unit M, Selective, unit with motor; Prog. Amid., Progressive amidship; S-Unit X, Selective, unit with axle. Driven Through: Rad. Rod, Radius rod; Tor. tube, Torque tube. Rear Axle: % float, semi-floating; float, floating. Rear springs: Plat., Platform. Bearings: B. & R., Ball and roller.

SPECIFICATIONS OF 1916 FOUR-CYLINDER GASOLINE PLEASURE CARS.

For Full Information Regarding Prices, the Seating Capacities and the Various Body Styles, See the General Indexes.

Make	Stearns-Knight	Sterling-N. Y.	Studebaker	Stutz	Trumbull	White	Willis-Knight
Model	SK 4	Sterling-N. Y.	4-40	C Road. Bearcat	16 B	G. E. D.	84 B
Bore and Stroke	3.750x5.625	3.000x4.250	3.875x5.000	4.750x5.500	4.750x5.000	4.750x5.125	4.125x4.500
H. P., S. A. E.	22.50	14.40	24.03	36.10	13.23	22.50	27.23
Piston Dia., Cu. In.	248.5	120.2	235.8	389.9	103.7	226.4	240.5
Cyls., Type, Cast.	4-Knl. 4	4-L-4	4-L-4	4-T-2	4-L-4	4-L-4	4-Knl.-4
Make of Motor	Own	Own	Own	Wisconsin	Milwaukee	White	Own
Valve Location	Knights	L. & H.	Left	Opposite	Right	Right	Knights
Camshaft Drive	Chain	Helical	Pump	Spur	Helical	Helical	Chain
Cooling System	Pump	Ther. Syd.	Spl. pres.	Pump	Ther. Syd.	Pump	Ther.-Syd.
Lub. System	Pressure	Spl. pres.	Spl. pres.	Pressure	Spl. pres.	Spl. pres.	Pressure
Oil Pump	Gear	Piston	Gear	Gear	Piston	Piston	Osc. plunger
Ignition System	Single H. T.	Single	Single	H. T.	Single	Single	Single
Ignition, Control	Rem. manual	Opt.	Rem. hand	Bosch	Split, hand	Bosch hand	Split, hand
Carburetor	Schebler	Opt.	Schebler	Stromberg	Zephyr	Stewart	Tillotson
Fuel Feed	Gravity	Gravity	Gravity	Gravity	Gravity	Vacuum	Vacuum
Starting System	West.	Opt.	Stud., Wag.	Rem. hand	R. & M.	Own	Auto-Lite
Lubricating System	West.	Opt.	Electric	Rem. hand	K. & D.	Own	Auto-Lite
Clutch	Cone	Cone	Cone	Cone	Disc	Plate	Cone
Gearset Type	S-Unit M	S-Unit M	Selective	S-Unit X	S-Unit X	Sel. amid.	S unit, X
Speed Ratios	Three	Three	Three	Three	Three	Four	Three
Driven Through	Springs	Springs	Rad. rod	Rad. rod	Tor. tube	Rad. rod	Tor. tube
Rear Axle	1/2 float.	1/2 float.	Float.	1/2 float.	1/2 float.	1/2 float.	Float.
Direct Drive Rat.	4.50-1	4.06-1	4.00-1	2.80-1	3.60-1	1/2 float.	4.00-1
Wheelbase	119	102	112	120	80	115	114
Tire Size	34x4, 34x4	30x3 1/2, 30x3 1/2	34x4, 34x4	34x4 1/2, 34x4 1/2	28x3, 28x3	32x4, 32x4	36x4 1/2, 36x4 1/2
Wheels	Opt.	Wood	Wood	Wood	Wire	Wood	Wood
Rear Springs	Opt.	Wood	Wood	Wood	Wire	Wood	Wood
Drive and Control	Left, centre	Cantilever	1/2 elliptic	1/2 elliptic	Cantilever	1/2 elliptic	1/2 elliptic
Eng. Main Bear.	Plain three	Left, centre	Left, centre	Right	Opt., centre	Left, centre	Left, centre
Gearset Bearings	B. & R.	Roller	Plain three	Plain three	Two	B. 2, plain 1	Plain
Rear Axle Bear.	B. & R.	Roller	Roller	B. & R.	Ball	Ball	Ball
Front Axle Bear.	Ball	B. & R.	Roller	B. & R.	B. & R.	Ball	Roller

SPECIFICATIONS OF 1916 SIX-CYLINDER GASOLINE PLEASURE CARS.

Make	Abbott-Detroit	Anderson	Apperson	Anbar	Austin	Buick
Model	6-44	6-40	6-16	6-38	36-66	D 44, D 45
Bore and Stroke	3.250x4.500	3.250x4.500	3.500x5.000	3.500x5.000	4.500x6.000	3.250x4.500
H. P., S. A. E.	25.35	25.35	29.40	21.60	48	25.35
Piston Dia., Cu. In.	254.0	224	288.6	212.0	572	224.0
Cyls., Type, Cast.	6-L-6	6-L-6	6-L-6	6-L-6	6-T-6	6-L-6
Make of Motor	Continental	Continental	Continental	Rutenber	Slide	Own
Valve Location	Left	Right	Right	Right	Slide	Head
Camshaft Drive	Helical	Helical	Helical	Helical	Gear	Helical
Cooling System	Pump	Pump	Pump	Pump	Water	Pump
Lub. System	Spl. pres.	Pressure	Pressure	Spl. pres.	Spl. & force	Spl. pres.
Oil Pump	Piston	Plunger	Gear	Vane	.....	Gear
Ignition System	Single	West.	Dual	Single	Two spark	Single
Ignition, Control	Rem. hand	West. hand	Delco, hand	Rem. H. & A.	Bosch, hand	Delco
Carburetor	Zenith	Zenith	Rayfield	Rayfield	Master	Marvel
Fuel Feed	Vacuum	Gravity	Vacuum	Vacuum	Vacuum	Vacuum
Starting System	Rem. hand	West.	Bijur	Rem. hand	Bosch	Delco
Lighting System	Rem. hand	West.	Bijur	Rem. hand	Bosch	Delco
Clutch	Plate	Disc	Sel. amid.	Cone	Disc	Cone
Gearset Type	S-Unit, M	Sliding	Three	S-Unit, M	Selective	S-Unit, M
Speed Ratios	Three	Three	Three	Three	Six	Three
Driven Through	Springs	Springs	Springs	Springs	Axle	Tor. tube
Rear Axle	1/2 float.	1/2 float.	1/2 float.	Float.	Austin	Float
Direct Drive Rat.	4.58-1	4.42-1	3.92-1	4.42-1	2.00-1	3.77-1
Wheelbase	122	120	128	120	142	115
Tire Size	32x4, 32x4	33x4, 33x4	34x4, 34x4	34x4, 34x4	34x4 1/2, 34x4 1/2	36x4 1/2, 36x4 1/2
Wheels	Wood	Wood	Wood	Wood	Wood	Wood
Rear Springs	1/2 elliptic	1/2 elliptic	1/2 elliptic	Cantilever	D. cantilever	Cantilever
Drive and Control	Left, centre	Left, centre	Left, centre	Left, centre	Plain	Left, centre
Eng. Main Bear.	Plain 3	Bronze	Plain four	Plain	An. ball	Plain four
Gearset Bearings	Roller	Roller	Roller	Ball	An. ball	Ball
Rear Axle Bear.	Roller	Roller	Roller	Ball	An. ball	Ball
Front Axle Bear.	Ball	Ball	Ball	B. & R.	Roller	Ball

Make	Chadwick	Chalmers	Chalmers	Chandler	Crawford	Davlin	Davlin	Defroiter
Model	19	44	40	17	440	4-25	4-F	6-45
Bore and Stroke	6.000x6.000	3.500x5.000	3.125x5.000	3.375x5.000	3.500x5.250	3.500x5.250	3.500x4.500	3.500x4.500
H. P., S. A. E.	38.40	23.40	23.44	27.34	29.40	29.40	26.35	26.35
Piston Dia., Cu. In.	41.7	317.5	230.1	268.4	303.1	303.1	224.0	223.95
Cyls., Type, Cast.	6-T-3	6-T-6	6-I-6	6-L-3	6 en bloc	6-L-6	6-L-6	6-L-6
Make of Motor	Own	Own	Own	Own	.....	Own	Continental	Continental
Valve Location	Opposite	Opposite	Head	Right	Slide	Right	Right	Left
Camshaft Drive	Helical	Helical	Worm	Chain	Helical	Helical	Helical	Pump
Cooling System	Pump	Ther.-Sysp.	Ther.-Sysp.	Pump	Pump	Pump	Pump	Pump
Oil Pump	Spl. pres.	Spl. pres.	Spl. pres.	Spl. pres.	Spl. & F. F.	Spl. & F. F.	Spl. & F. F.	Spl. & F. F.
Ignition System	Single	Single	Single	Single	Single	Single	Single	Single
Ignition, Control	Bosch, hand	At.-Kt. H. & A.	At.-Kt. H. & A.	Bosch, hand	Bosch	Delco, H. & A.	Delco, H. & A.	Delco, H. & A.
Carburetor	Rayfield	Rayfield	Rayfield	Rayfield	Stromberg	Stromberg	Stromberg	Stromberg
Fuel Feed	Grav. pres.	Grav. pres.	Grav. pres.	Grav. pres.	Vacuum	Vacuum	Vacuum	Vacuum
Starting System	Entz	Entz	G. & D.	G. & D.	West	Delco	Delco	Delco
Lighting System	Entz	Entz	G. & D.	G. & D.	West	Delco	Delco	Delco
Clutch	Disc	Disc	Plate	Plate	Disc	Cone	Cone	Cone
Ex. band	S-Unit, M	S-Unit, X	S-Unit, X	S-Unit, M	S-Unit, M	S-Unit, M	S-Unit, M	S-Unit, M
Speed Ratio	Four	Three	Three	Three	Three	Three	Three	Three
Driven Through	Spl. pres.	Tor. tube	Tor. tube	Spl. pres.	% float.	% float.	% float.	% float.
Rear Axle	Dead	Float.	% float.	% float.	% float.	% float.	% float.	% float.
Direct Drive Rat.	2.25-1	3.75-1	4.00-1	4.40-1	4.58-1	4.58-1	4.42-1	4.58-1
Wheelbase	133	126	124	123	120	124	120	118
Tire Size	36x4 1/2, 36x4 1/2	34x4 1/2, 34x4 1/2	34x4 1/2, 34x4 1/2	34x4 1/2, 34x4 1/2	34x4 1/2, 34x4 1/2	34x4 1/2, 34x4 1/2	34x4 1/2, 34x4 1/2	33x4 1/2, 33x4 1/2
Wheels	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood
Rear Springs	% elliptic	% elliptic	% elliptic	% elliptic	% elliptic	% elliptic	% elliptic	% elliptic
Drive and Control	Right	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre
Eng. Main Bear.	Plain three	Plain three	Plain three	Plain three	Plain three	Plain three	Plain three	Plain three
Gearset Bearings	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Rear Axle Bear.	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Front Axle Bear.	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Make	Elgin Six	Elgin Six	Elgin Six	Franklin	Glide	Grant	Great Western	Halladay
Model	1-A-6	60	56	8	6-40	V	Great Western	R-2
Bore and Stroke	3.000x4.250	3.250x4.500	4.000x6.000	3.625x4.000	3.000x5.000	3.000x4.250	3.000x5.000	3.000x5.000
H. P., S. A. E.	38.40	25.35	46.50	31.54	21.60	21.60	21.60	21.60
Piston Dia., Cu. In.	37.0	364.0	364.0	247.4	212.0	180.2	212.0	212.0
Cyls., Type, Cast.	6-L-6	6-L-6	6-L-6	6-L-1	6-L-6	6-L-6	6 en bloc	6-L-6
Make of Motor	Own	Own	Own	Own	Own	Own	.....	Rutenber
Valve Location	Over head	Right	Left	Head	Right	Head	Slide	Left
Camshaft Drive	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Helical
Cooling System	Ther.-Sysp.	Pump	Pump	Alr	Pump	Ther.-Sysp.	Pump	Pump
Lub. System	Spl. F. F.	Spl. pres.	Pressure	Pressure	Spl. pres.	Spl. pres.	Spl. pres.	Spl. pres.
Oil Pump	Centrifugal	Piston	Gear	Gear	Gear	Piston	.....	Gear
Ignition System	Single	Single	Dual	Single	Single	Single	Single	Single
Ignition, Control	Delco dis.	Conn., head	Bosch, hand	Elise-Auto	West, hand	At.-Kt. H. & A.	Remy	West, hand
Carburetor	Rayfield	Schebler	Own	Own	Rayfield	Rayfield	Schebler	Stromberg
Fuel Feed	Vacuum	Vacuum	Pressure	Gravity	Vacuum	Gravity	Vacuum	Vacuum
Starting System	Single	Auto-Lite	Own	Dyneto	West.	Allis-Chal.	Ward-L.	West.
Lighting System	West.	Dyneto	Own	Dyneto	West.	Allis-Chal.	Ward-L.	West.
Clutch	Disc	Cone	Disc	Disc	Disc	Cone	Disc	Plate
Ex. band	S-Unit, M	S-Unit, M	Sel. amld.	Sel. amld.	S-Unit, M	S-Unit, M	S-Unit, M	S-Unit, M
Speed Ratio	Three	Three	Four	Three	Three	Three	Three	Three
Driven Through	Spl. pres.	Spl. pres.	Tor. tube	Spl. pres.	Spl. pres.	Tor. tube	.....	Spl. pres.
Rear Axle	Bevel gear	% float.	% float.	% float.	% float.	% float.	% float.	% float.
Direct Drive Rat.	4.08-1	4.417-1	3.06-1	4.00-1	4.64-1	4.00-1	4.62-1	4.62-1
Wheelbase	114	120	135	120	119	120	120	122
Tire Size	32x3 1/2, 32x3 1/2	34x4 1/2, 34x4 1/2	36x4 1/2, 37x5	34x4 1/2, 34x4 1/2	32x3 1/2, 32x3 1/2	32x3 1/2, 32x3 1/2	34x4 1/2, 34x4 1/2	34x4 1/2, 34x4 1/2
Wheels	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood
Rear Springs	Cantilever	% elliptic	% elliptic	% elliptic	% elliptic	% elliptic	% elliptic	% elliptic
Drive and Control	Left, centre	Left, centre	Right	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre
Eng. Main Bear.	Plain	Plain	Plain four	Plain seven	Plain three	Plain	Three	Plain
Gearset Bearings	Roller	Roller	Roller	Roller	Roller	Roller	.....	Roller
Rear Axle Bear.	Roller	Roller	Roller	Roller	Roller	Roller	.....	Roller
Front Axle Bear.	Roller	Roller	Roller	Roller	Roller	Roller	.....	Roller

ABBREVIATIONS—Cyls., total number; Type, shape of motor; Cast, pairs, fours, sixes or eights. Make of Motor: Hersch-Spillm.; G. B. S., Rut. Beav., Rutenber & Swartz; Rut. Beav., Thermo-syphon. Lubrication System: Spl. pres., Splash and pressure; Clr. pres., circulating pressure; Spl. & F., Splash and force feed. Ignition Control: Ig-Ther-Syp., Thermo-syphon. Ther-Syp., Thermosiphon. Water-Kent, At-Water-Kent; Mtlton, Conn., Connecticut; West., Westinghouse; G. & D., Gray & Davis; Allis-Ch., Allis Chalmers; Stud. Wag., Studebaker Wagner; Leece-N., Leece-Newton; West., Westinghouse; Apico, Apeldoorn; Blj.-West., Bljouw-West. Gearset type: S-Unit M. Selective, unit with motor; Prog. Amid., Progressive amidship; S-Unit X. Selective, unit with axle. Driven T through: Rad. Rod, Radius rod; Tor. tube, Torque tube. Rear Axle: $\frac{1}{2}$ float, semi-floating; float, floating. Rear springs: Plat., Platform. Bearings: B. & R., Ball and roller.

SPECIFICATIONS OF 1916 SIX-CYLINDER GASOLINE PLEASURE CARS.

For Full Information Regarding Prices, the Seating Capacities and the Various Body Styles, See the General Indexes.

Make	Model	Haynes	Herf-Brooks	Hudson	Jeffery	Kiesel-Kar	Kilme	Lenox	Lewis
Model	36	36	H-6-50	Super-Six	6	6-42	6-36	0	VI
Bore and Stroke	3,500x5,000	3,500x5,000	4,000x4,500	3,500x5,000	3,500x5,250	3,625x5,500	3,250x4,500	3,500x5,125	3,250x5,000
H. P., S. A. E.	28.40	28.40	38.40	29.40	29.4	31.54	25.35	29.40	25.50
Piston Dis., Cu. In.	288.6	339.3	339.3	339.3	339.3	340.8	224.0	298.6	298.6
Cyls., Type, Cast.	6-L-6	6-L-6	6-L-1	6-L-6	6-L-6	6-L-6	6-L-6	6-L-6	6 en bloc
Make of Motor	Own	Own	Own	Own	Buda	Kiesel	Continental	Buda	.....
Valve Location	Right	Left	Left	L head	Right	Right	Right	Left	Side
Camshaft Drive	Spiral	Pump	Pump	Helical	Helical	Helical	Helical	Helical	Chain
Cooling System	Pump	Splash	Splash	Pump	Pump	Pump	Pump	Pump	Pump
Lub. System	Piston	Piston	Piston	Splash	Splash	Cir. spl.	Spl. pres.	Spl. pres.	Spl. & F. F.
Oil Pump	Battery	Single	Single	Single	Single	Single	Single	Single	.....
Ignition System	Ignition	Ignition	Ignition	Ignition	Ignition	Ignition	Ignition	Ignition	.....
Ignition Control	Control	Control	Control	Control	Control	Control	Control	Control	.....
Carburetor	.....	.....	.....	.....	.....	.....	.....	.....	.....
Fuel Feed	.....	.....	.....	.....	.....	.....	.....	.....	.....
Starting System	.....	.....	.....	.....	.....	.....	.....	.....	.....
Lighting System	.....	.....	.....	.....	.....	.....	.....	.....	.....
Clutch	.....	.....	.....	.....	.....	.....	.....	.....	.....
Gearset Type	.....	.....	.....	.....	.....	.....	.....	.....	.....
Speed Ratios	.....	.....	.....	.....	.....	.....	.....	.....	.....
Driven Through	.....	.....	.....	.....	.....	.....	.....	.....	.....
Rear Axle	.....	.....	.....	.....	.....	.....	.....	.....	.....
Direct Drive Rat.	4.43-1	4.08-1	4.08-1	4.08-1	4.31-1	3.92-1	4.50-1	3.75-1	.....
Wheelbase	127	131	120	125.50	131	126	120	128	135
Tire Size	34x4, 34x4	34x4, 34x4	34x4, 34x4	35x4, 36x4	35x4, 36x4	34x4, 34x4	34x4, 34x4	34x4, 36x4	36x4, 36x4
Wheels	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wire	.....
Rear Springs	.....	.....	.....	.....	.....	.....	.....	.....	.....
Drive and Control	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre
Eng. Main Bear.	Plain three	Plain three	Plain seven	Plain four	Four	Plain three	Plain three	Plain four	Three
Gearset Bearings	Ball	Ball	Ball	Roller	Roller	Roller	Roller	Ball	.....
Rear Axle Bear.	Ball	Ball	Ball	Con. roller	Roller	Roller	Roller	Ball	.....
Front Axle Bear.	Ball	Ball	Roller	Con. roller	Roller	Roller	Ball	Ball	.....
Make	Lexington	Lexington	Lexington	Lexington	Lexington	Lexington	Lexington	Lexington	Lexington
Model	6-0	6-0	6-0	6-0	6-0	6-0	6-0	6-0	6-0
Bore and Stroke	3,250x4,500	3,250x4,500	3,250x4,500	3,250x4,500	3,250x4,500	3,250x4,500	3,250x4,500	3,250x4,500	3,250x4,500
H. P., S. A. E.	28.39	28.39	28.39	28.39	28.39	28.39	28.39	28.39	28.39
Piston Dis., Cu. In.	234	234	234	234	234	234	234	234	234
Cyls., Type, Cast.	6-L-6	6-L-6	6-L-6	6-L-6	6-L-6	6-L-6	6-L-6	6-L-6	6-L-6
Make of Motor	Continental	Continental	Continental	Continental	Continental	Continental	Continental	Continental	Continental
Valve Location	Right	Right	Right	Right	Right	Right	Right	Right	Right
Camshaft Drive	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Helical
Cooling System	Pump	Pump	Pump	Pump	Pump	Pump	Pump	Pump	Pump
Lub. System	.....	.....	.....	.....	.....	.....	.....	.....	.....
Oil Pump	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ignition System	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ignition Control	.....	.....	.....	.....	.....	.....	.....	.....	.....
Carburetor	.....	.....	.....	.....	.....	.....	.....	.....	.....
Fuel Feed	.....	.....	.....	.....	.....	.....	.....	.....	.....
Starting System	.....	.....	.....	.....	.....	.....	.....	.....	.....
Lighting System	.....	.....	.....	.....	.....	.....	.....	.....	.....
Clutch	.....	.....	.....	.....	.....	.....	.....	.....	.....
Gearset Type	.....	.....	.....	.....	.....	.....	.....	.....	.....
Speed Ratios	.....	.....	.....	.....	.....	.....	.....	.....	.....
Driven Through	.....	.....	.....	.....	.....	.....	.....	.....	.....
Rear Axle	.....	.....	.....	.....	.....	.....	.....	.....	.....
Direct Drive Rat.	4.07-1	4.07-1	4.07-1	4.07-1	4.07-1	4.07-1	4.07-1	4.07-1	4.07-1
Wheelbase	132	132	132	132	132	132	132	132	132
Tire Size	32x4, 32x4	32x4, 32x4	32x4, 32x4	32x4, 32x4	32x4, 32x4	32x4, 32x4	32x4, 32x4	32x4, 32x4	32x4, 32x4
Wheels	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood
Rear Springs	.....	.....	.....	.....	.....	.....	.....	.....	.....
Drive and Control	Right, centre	Right, centre	Right, centre	Right, centre	Right, centre	Right, centre	Right, centre	Right, centre	Right, centre
Eng. Main Bear.	Plain three	Plain three	Plain seven	Plain seven	Plain seven	Plain seven	Plain seven	Plain three	Plain three
Gearset Bearings	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Ball
Rear Axle Bear.	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Ball
Front Axle Bear.	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Ball

Make	Model	Marion-Mandley	Marion	McFarlan	Mitchell Six	Monitor	Moore	National
Model	Model	Model	Model	Model	Model	Model	Model	Model
Bore and Stroke	3.750x5.125	4.000x6.000	4.000x6.000	4.000x6.000	4.000x6.000	4.000x6.000	4.000x6.000	4.000x6.000
H. P.	33.75	38.40	48.60	48.60	48.60	48.60	48.60	48.60
Plat. Dia., Cu. In.	33.9	45.2	57.5	57.5	57.5	57.5	57.5	57.5
Cyls., Type, Cast	6-1-6	6-1-6	6-1-6	6-1-6	6-1-6	6-1-6	6-1-6	6-1-6
Make of Motor	Own	Teetor	Teetor	Teetor	Own	Own	Continental	National
Valve Location	Head	Opposite	Opposite	Opposite	Left	Left	Right	Right
Camshaft Drive	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Helical
Cooling System	Pump	Pump	Pump	Pump	Pump	Pump	Pump	Pump
Lub. System	Pressure	Spl. pres.	Spl. pres.	Spl. pres.	Spl. pres.	Spl. pres.	Spl. pres.	Spl. pres.
Oil Pump	Plunger	Plunger	Plunger	Plunger	Plunger	Plunger	Plunger	Plunger
Ignition System	Single	Single	Single	Single	Single	Single	Single	Single
Ignition, Control	West, hand	West, hand	West, hand	West, hand	West, hand	West, hand	West, hand	West, hand
Carburetor	Stromberg	Stromberg	Stromberg	Stromberg	Stromberg	Stromberg	Stromberg	Stromberg
Fuel Feed	Pres.-grav.	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum
Starting System	West	West	West	West	West	West	West	West
Lighting System	West	West	West	West	West	West	West	West
Clutch	Disc	Cone	Cone	Cone	Cone	Cone	Cone	Cone
Gearset Type	S-Unit, X	S-Unit, X	S-Unit, X	S-Unit, X	S-Unit, X	S-Unit, X	S-Unit, X	S-Unit, X
Speed Ratios	Three	Three	Three	Three	Three	Three	Three	Three
Driven Through	Tor. tube	Tor. tube	Tor. tube	Tor. tube	Tor. tube	Tor. tube	Tor. tube	Tor. tube
Rear Axle	% float	% float	% float	% float	% float	% float	% float	% float
Direct Drive Rat.	4.42-1	3.69-1	3.715-1	3.715-1	3.715-1	3.715-1	3.715-1	3.715-1
Wheelbase	120	136	132	132	132	132	132	132
Tire Size	32x4, 32x4	36x4, 36x4	36x4, 36x4	36x4, 36x4	36x4, 36x4	36x4, 36x4	36x4, 36x4	36x4, 36x4
Wheels	Wire	Wire	Wire	Wire	Wire	Wire	Wire	Wire
Rear Springs	% elliptic	% elliptic	% elliptic	% elliptic	% elliptic	% elliptic	% elliptic	% elliptic
Drive and Control	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre
Eng. Main Bear.	Plain three	Plain four	Plain four	Plain four	Plain four	Plain four	Plain four	Plain four
Gearset Bearings	Annular	B. & R.	B. & R.	B. & R.	B. & R.	B. & R.	B. & R.	B. & R.
Rear Axle Bear.	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Front Axle Bear.	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Make	National	Norwalk	Norwalk	Norwalk	Norwalk	Norwalk	Norwalk	Norwalk
Model	Model	Model	Model	Model	Model	Model	Model	Model
Bore and Stroke	3.750x5.500	4.000x5.500	4.000x5.500	4.000x5.500	4.000x5.500	4.000x5.500	4.000x5.500	4.000x5.500
H. P.	33.75	48	48	48	48	48	48	48
Plat. Dia., Cu. In.	33.9	45.2	45.2	45.2	45.2	45.2	45.2	45.2
Cyls., Type, Cast	6-1-6	6-1-6	6-1-6	6-1-6	6-1-6	6-1-6	6-1-6	6-1-6
Make of Motor	Her. Spillman	Her. Spillman	Her. Spillman	Her. Spillman	Her. Spillman	Her. Spillman	Her. Spillman	Her. Spillman
Valve Location	Opposite	Opposite	Opposite	Opposite	Opposite	Opposite	Opposite	Opposite
Camshaft Drive	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Helical
Cooling System	Pump	Pump	Pump	Pump	Pump	Pump	Pump	Pump
Lub. System	Plunger	Plunger	Plunger	Plunger	Plunger	Plunger	Plunger	Plunger
Ignition System	Single	Single	Single	Single	Single	Single	Single	Single
Ignition, Control	West, hand	West, hand	West, hand	West, hand	West, hand	West, hand	West, hand	West, hand
Carburetor	Rayfield	Rayfield	Rayfield	Rayfield	Rayfield	Rayfield	Rayfield	Rayfield
Fuel Feed	Pressure	Pressure	Pressure	Pressure	Pressure	Pressure	Pressure	Pressure
Starting System	West	West	West	West	West	West	West	West
Lighting System	West	West	West	West	West	West	West	West
Clutch	Cone	Cone	Cone	Cone	Cone	Cone	Cone	Cone
Gearset Type	Selective	Selective	Selective	Selective	Selective	Selective	Selective	Selective
Speed Ratios	Three	Three	Three	Three	Three	Three	Three	Three
Driven Through	Spring	Spring	Spring	Spring	Spring	Spring	Spring	Spring
Rear Axle	% float	% float	% float	% float	% float	% float	% float	% float
Direct Drive Rat.	4.08-1	3.78-1	3.78-1	3.78-1	3.78-1	3.78-1	3.78-1	3.78-1
Wheelbase	134	136	136	136	136	136	136	136
Tire Size	36x4, 36x4	36x4, 36x4	36x4, 36x4	36x4, 36x4	36x4, 36x4	36x4, 36x4	36x4, 36x4	36x4, 36x4
Wheels	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood
Rear Springs	Cantilever	% elliptic	% elliptic	% elliptic	% elliptic	% elliptic	% elliptic	% elliptic
Drive and Control	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre
Eng. Main Bear.	Plain four	Plain three	Plain three	Plain three	Plain three	Plain three	Plain three	Plain three
Gearset Bearings	Ball	An. ball	An. ball	An. ball	An. ball	An. ball	An. ball	An. ball
Rear Axle Bear.	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Front Axle Bear.	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller

ABBREVIATIONS—Cyls., total number; Type, shape of motor; Cast, pairs, four, six, eight, Make of Motor: Hersch-Spill, Hersch-Spillman; G. B. S., Golden, Belknap & Swartz; Rut. Beav., Rutenber & Beaver; Valve Location: R. & H., Right and Head; Knight, Knight Sleeve Type; In V, in alley of an eight or 12. Cooling Systems: Ther.-Syp., Thermo-syphon. Lubrication System: Spl. pres., Spl. pres. and pressure; Cir. pres., circulating pressure; Spl., & F., Spl. and force feed, Ignition Control: Ignition, Conn., Connecticut; West, Westinghouse; At.-Kent, Atwater-Kent; Split, Splitdorf; Control, H. & A., Hand and automatic; At., automatic, starting system; West, Westinghouse; Apico, Apico; Bly-West, Bly-West; Blyur-Westinghouse; G. & D., Gray & Davis; Allis-Ch., Allis Chalmers; Stud. Wag., Studebaker Wagner; Leese-N., Leese-Neville. Gearset Type: S-Unit M, Selective, unit with motor; Prog. Amid., Progressive amidship; S-Unit X, Selective, unit with axle. Driven Through: Rad. Rod, Radius rod; Tor. tube, Torque tube. Rear Axle: % float, semi-floating; Float, floating. Rear springs: Plat., Platform. Bearings: B. & R., Ball and roller.

SPECIFICATIONS OF 1916 SIX-CYLINDER GASOLINE PLEASURE CARS.

For Full Information Regarding Prices, the Seating Capacities and the Various Body Styles, See the General Indexes.

Make	Model	Pathfinder	Pierce-Arrow	Pierce-Arrow	Pierce-Arrow	Pilot	Pilot	Pilot	Premier	Pullman
H. P., S. A. E.	3,500x5.250	48-B-4	48-B-4	38 C 4	6-45	6-55	6-55	6-56	6-56	6-48
H. P., S. A. E.	29.40	48.60	48.60	38.40	21.60	36.04	36.04	38.40	38.40	3,750x5.250
Platon Dis., Cu. In.	303.1	824.7	824.7	414.7	212.0	371.4	371.4	414.7	414.7	33.75
Cyls., Type, Cast.	6-L-6	6-T-2	6-T-2	6-T-2	6-L-6	6-T-6	6-T-6	6-T-3	6-L-3	347.9
Make of Motor	Continental	Own	Own	Own	Teetor	Teetor	Teetor	Own	Own	.....
Valve Location	Right	Opposite	Opposite	Opposite	Right	Opposite	Opposite	Opposite	Opposite	Left
Camshaft Drive	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Helical
Cooling System	Pump	Pump	Pump	Pump	Pump	Pump	Pump	Pump	Pump	Pump
Lub. System	Splash	Gear	Gear	Gear	Gear	Gear	Gear	Gear	Gear	Gear
Oil Pump	Piston	Double	Double	Double	Double	Double	Double	Double	Double	Double
Ignition System	Single	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand
Ignition Control	West, hand	Own	Own	Own	Own	Own	Own	Own	Own	Own
Carburetor	Stromberg	Pressure	Pressure	Pressure	Pressure	Pressure	Pressure	Pressure	Pressure	Pressure
Fuel Feed	Gravity	West.	West.	West.	West.	West.	West.	West.	West.	West.
Starting System	West.	West.	West.	West.	West.	West.	West.	West.	West.	West.
Lighting System	West.	Cone	Cone	Cone	Cone	Cone	Cone	Cone	Cone	Cone
Clutch	Disc	Selective	Selective	Selective	Selective	Selective	Selective	Selective	Selective	Selective
Gearset Type	Three	Four	Four	Four	Four	Four	Four	Four	Four	Four
Speed Ratio	Three	Springs	Springs	Springs	Springs	Springs	Springs	Springs	Springs	Springs
Driven Through	Springs	1/2 float.	1/2 float.	1/2 float.	1/2 float.	1/2 float.	1/2 float.	1/2 float.	1/2 float.	1/2 float.
Rear Axle	Float.	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.
Direct Drive Rat.	4.00-1	147.5	147.5	147.5	147.5	147.5	147.5	147.5	147.5	147.5
Wheelbase	122	37x5, 38x5 1/2	37x5, 37x5	37x5, 37x5	37x5, 37x5	37x5, 37x5	37x5, 37x5	37x5, 37x5	37x5, 37x5	37x5, 37x5
Tire Size	35x4 1/2	35x4 1/2	35x4 1/2	35x4 1/2	35x4 1/2	35x4 1/2	35x4 1/2	35x4 1/2	35x4 1/2	35x4 1/2
Wheels	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood
Rear Springs	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control
Drive and Control	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre
Eng. Main Bear.	Plain	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Ball
Gearset Bearings	Ball	B. & R.	B. & R.	B. & R.	B. & R.	B. & R.	B. & R.	B. & R.	B. & R.	B. & R.
Rear Axle Bear.	B. & R.	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Front Axle Bear.	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Make	Model	Reo	Reo	Reo	Reo	Reo	Reo	Reo	Reo	Reo
H. P., S. A. E.	30.46	42.56	42.56	42.56	42.56	42.56	42.56	42.56	42.56	42.56
Platon Dis., Cu. In.	306.6	425.6	425.6	425.6	425.6	425.6	425.6	425.6	425.6	425.6
Cyls., Type, Cast.	6-L-3	6-T-2	6-T-2	6-T-2	6-T-2	6-T-2	6-T-2	6-T-2	6-T-2	6-T-2
Make of Motor	Own	Wisconsin	Wisconsin	Wisconsin	Wisconsin	Wisconsin	Wisconsin	Wisconsin	Wisconsin	Wisconsin
Valve Location	R. & H.	Opposite	Opposite	Opposite	Opposite	Opposite	Opposite	Opposite	Opposite	Opposite
Camshaft Drive	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Helical
Cooling System	Pump	Pump	Pump	Pump	Pump	Pump	Pump	Pump	Pump	Pump
Lub. System	Splash	Gear	Gear	Gear	Gear	Gear	Gear	Gear	Gear	Gear
Oil Pump	Piston	Double	Double	Double	Double	Double	Double	Double	Double	Double
Ignition System	Single	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand
Ignition Control	Remy, hand	Own	Own	Own	Own	Own	Own	Own	Own	Own
Carburetor	Johnson	Stromberg	Stromberg	Stromberg	Stromberg	Stromberg	Stromberg	Stromberg	Stromberg	Stromberg
Fuel Feed	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum
Starting System	Remy	Delco	Delco	Delco	Delco	Delco	Delco	Delco	Delco	Delco
Lighting System	Remy	Cone	Cone	Cone	Cone	Cone	Cone	Cone	Cone	Cone
Clutch	Disc	Selective	Selective	Selective	Selective	Selective	Selective	Selective	Selective	Selective
Gearset Type	Three	Four	Four	Four	Four	Four	Four	Four	Four	Four
Speed Ratio	Three	Rad. rods	Rad. rods	Rad. rods	Rad. rods	Rad. rods	Rad. rods	Rad. rods	Rad. rods	Rad. rods
Driven Through	Springs	Float.	Float.	Float.	Float.	Float.	Float.	Float.	Float.	Float.
Rear Axle	Float.	4.00-1	4.00-1	4.00-1	4.00-1	4.00-1	4.00-1	4.00-1	4.00-1	4.00-1
Direct Drive Rat.	4.00-1	133	133	133	133	133	133	133	133	133
Wheelbase	126	36x4 1/2	36x4 1/2	36x4 1/2	36x4 1/2	36x4 1/2	36x4 1/2	36x4 1/2	36x4 1/2	36x4 1/2
Tire Size	34x4 1/2	34x4 1/2	34x4 1/2	34x4 1/2	34x4 1/2	34x4 1/2	34x4 1/2	34x4 1/2	34x4 1/2	34x4 1/2
Wheels	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood
Rear Springs	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control
Drive and Control	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre
Eng. Main Bear.	Plain three	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Ball
Gearset Bearings	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Rear Axle Bear.	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Front Axle Bear.	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Make	Model	Stearns-Knight	Stearns-Knight	Stearns-Knight	Stearns-Knight	Stearns-Knight	Stearns-Knight	Stearns-Knight	Stearns-Knight	Stearns-Knight
H. P., S. A. E.	30.46	42.56	42.56	42.56	42.56	42.56	42.56	42.56	42.56	42.56
Platon Dis., Cu. In.	306.6	425.6	425.6	425.6	425.6	425.6	425.6	425.6	425.6	425.6
Cyls., Type, Cast.	6-L-3	6-T-2	6-T-2	6-T-2	6-T-2	6-T-2	6-T-2	6-T-2	6-T-2	6-T-2
Make of Motor	Own	Wisconsin	Wisconsin	Wisconsin	Wisconsin	Wisconsin	Wisconsin	Wisconsin	Wisconsin	Wisconsin
Valve Location	R. & H.	Opposite	Opposite	Opposite	Opposite	Opposite	Opposite	Opposite	Opposite	Opposite
Camshaft Drive	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Helical	Helical
Cooling System	Pump	Pump	Pump	Pump	Pump	Pump	Pump	Pump	Pump	Pump
Lub. System	Splash	Gear	Gear	Gear	Gear	Gear	Gear	Gear	Gear	Gear
Oil Pump	Piston	Double	Double	Double	Double	Double	Double	Double	Double	Double
Ignition System	Single	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand	Bosch, hand
Ignition Control	Remy, hand	Own	Own	Own	Own	Own	Own	Own	Own	Own
Carburetor	Johnson	Stromberg	Stromberg	Stromberg	Stromberg	Stromberg	Stromberg	Stromberg	Stromberg	Stromberg
Fuel Feed	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum
Starting System	Remy	Delco	Delco	Delco	Delco	Delco	Delco	Delco	Delco	Delco
Lighting System	Remy	Cone	Cone	Cone	Cone	Cone	Cone	Cone	Cone	Cone
Clutch	Disc	Selective	Selective	Selective	Selective	Selective	Selective	Selective	Selective	Selective
Gearset Type	Three	Four	Four	Four	Four	Four	Four	Four	Four	Four
Speed Ratio	Three	Rad. rods	Rad. rods	Rad. rods	Rad. rods	Rad. rods	Rad. rods	Rad. rods	Rad. rods	Rad. rods
Driven Through	Springs	Float.	Float.	Float.	Float.	Float.	Float.	Float.	Float.	Float.
Rear Axle	Float.	4.00-1	4.00-1	4.00-1	4.00-1	4.00-1	4.00-1	4.00-1	4.00-1	4.00-1
Direct Drive Rat.	4.00-1	133	133	133	133	133	133	133	133	133
Wheelbase	126	36x4 1/2	36x4 1/2	36x4 1/2	36x4 1/2	36x4 1/2	36x4 1/2	36x4 1/2	36x4 1/2	36x4 1/2
Tire Size	34x4 1/2	34x4 1/2	34x4 1/2	34x4 1/2	34x4 1/2	34x4 1/2	34x4 1/2	34x4 1/2	34x4 1/2	34x4 1/2
Wheels	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood	Wood
Rear Springs	Control	Control	Control	Control	Control	Control	Control	Control	Control	Control
Drive and Control	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre
Eng. Main Bear.	Plain three	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Ball	Ball
Gearset Bearings	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Rear Axle Bear.	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller
Front Axle Bear.	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller	Roller

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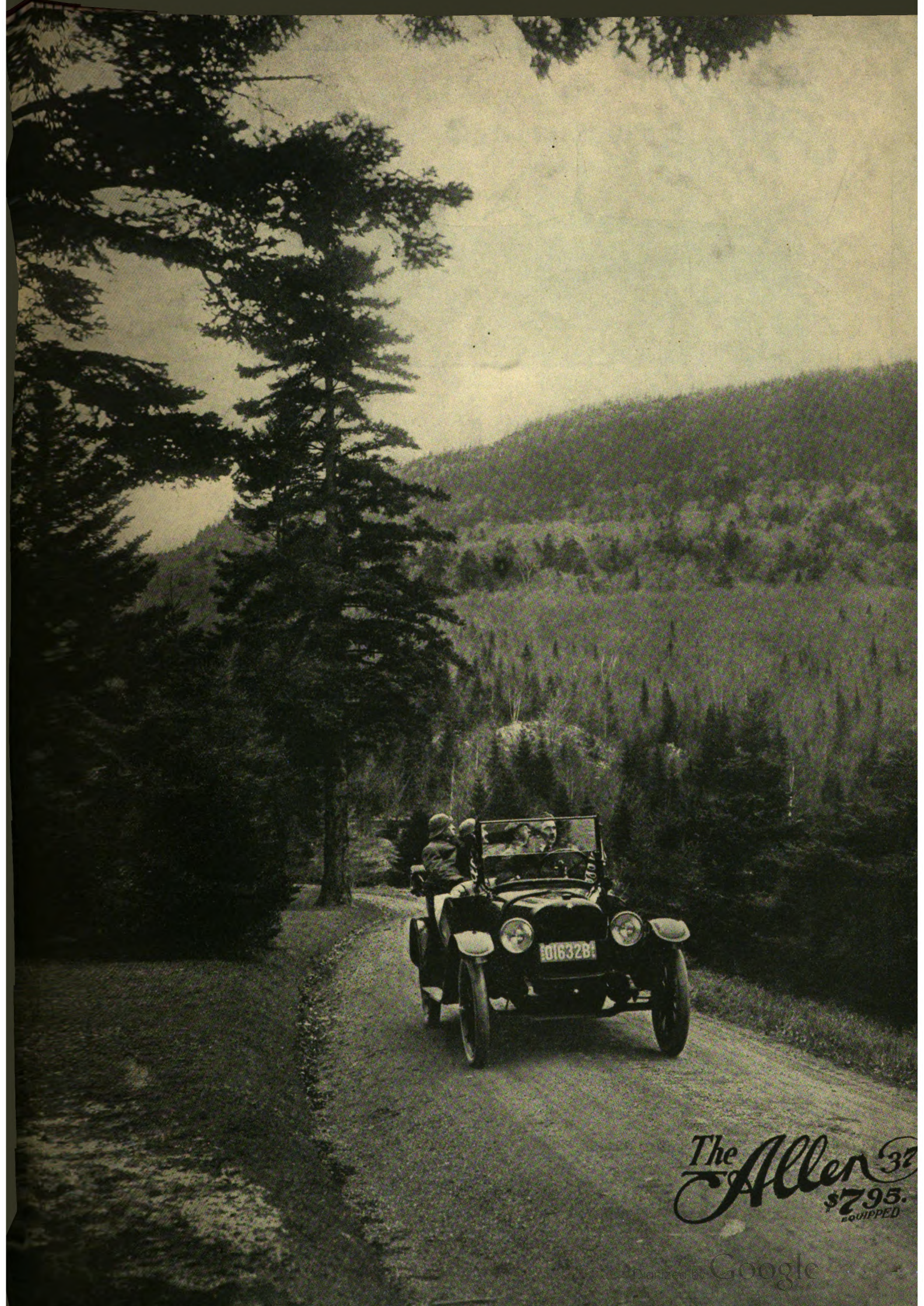
SPECIFICATIONS OF 1916 EIGHT-CYLINDER GASOLINE PLEASURE CARS.

Make	Abbott Detroit	Apperson	Briscoe	Cadillac	Cole	Cunningham	Daniels	Holler
Model	8-16	8	53	850	840	V	A	Holler Eight
Horse and Stroke	3.250x5.000	3.000x3.500	3.125x5.125	3.500x4.500	3.500x4.250	3.750x5.000	3.250x5.000	3.000x4.250
H. P., S. A. E.	31.25	28.80	31.25	39.20	39.20	45	33.80	28.80
Piston Dia., Cu. In.	33.80	306.8	314.4	346.3	346.3	441.8	331.8	240.3
Cyls., Type, Cast.	8-V-4	8-I-4	8-V-4	8-V-4	8-V-4	8-L-4	8-V-4	8-V-4
Make of Motor	Own	Ferro	Own	Northway	Northway	Cunningham	Hersch-Spill.	.....
Valve Location	Inside	Head	Inside	Inside	Inside	Left	Inside	In. V
Camshaft Drive	Helical	Helical	Chain	Helical	Helical	Helical	Helical	Helical
Cooling System	Ther.-Syp.	Ther. Syp.	Pump	Pump	Pump	Pump	Pump	Ther. Syp.
Lub. System	Pressure	Pressure	Pressure	Spl. pres.	Spl. pres.	Pressure	Pressure	Pressure
Oil Pump	Gear	.....	Gear	Gear	Gear	Gear	Gear	.....
Ignition System	Dual	Single	Single	Dual	Single	Battery	Single	Single
Ignition, Control	Remy, hand	Remy, hand	Delco, H. & A.	Delco, H. & A.	Delco	West	Stromberg	At.-Kent
Carburetor	Rayfield	Vacuum	Stromberg	Stromberg	Stromberg	West	Zenith	Stewart
Fuel Feed	Vacuum	Gravity	Pressure	Vacuum	Vacuum	Vacuum	Vacuum	Gravity
Starting System	Auto-Lite	Apico	Delco	Delco	Delco	West	West	Apico
Lighting System	Auto-Lite	Apico	Delco	Delco	Delco	West	West	Apico
Clutch	Disc	Cone	Disc	Cone	Cone	Disc	Disc	Cone
Gearset Type	S-Unit, M	Sel. amid	S-Unit, M	S-Unit, M	S-Unit, M	Sliding	S-Unit, M	S-Unit, M
Speed Ratios	Three	Three	Three	Three	Three	Three	Three	Three
Driven Through	Rad. rod	Springs	Springs	Springs	Springs	Shaft	Springs	.....
Rear Axle	1/2 float.	Float.	Float.	1/2 float.	Float.	4.09-1	4.52-1	Float.
Direct Drive Rat.	4.62-1	4.41-1	4.50-1	4.47-1	4.09-1	4.09-1	4.00-1	4.00-1
Wheelbase	121	114	122	126	127	130	127	115
Tire Size	35x4 1/4, 35x4 1/2	32x3 1/2, 32x3 1/2	36x4 1/4, 36x4 1/2	35x4 1/4, 35x4 1/2	35x4 1/2, 35x4 1/2	37x5, 37x5	34x4 1/2, 34x4 1/2	32x3 1/2, 32x3 1/2
Wheels	Wood	Wood	Wood	Wood	Wood	Opt.	Wood	Wood
Rear Springs	1/2 elliptic	Cantilever	Plat.	1/2 elliptic	1/2 elliptic	1/2 elliptic	1/2 elliptic	Cantilever
Drive and Control	Left, centre	Opt., centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre	Left, centre
Eng. Main Bear.	Plain three	Plain	Plain three	Plain three	Plain three	.....	Plain three	Three
Gearset Bearings	Roller	Plain	Ball	B. & R.	B. & R.	Ball	B. & R.	.....
Rear Axle Bear.	Roller	B. & R.	Roller	Roller	Roller	Ball	Roller	Annular
Front Axle Bear.	Roller	Ball	Roller	Roller	Roller	Ball	Roller	.....

ABBREVIATIONS—Cyls., total number; Type, shape of motor; Cast, pairs, fours, sixes or eights. **Make of Motor:** Hersch-Spill., Hersch-Spillman; G. B. Golden, Golden, Belknap & Swartz; Rut. Beav., Rutenber & Beaver. **Valve Location:** R. & H., Right and Head; Knlght, Knight Sleeve Type; In V, in alley of an eight or 12. **Control System:** Thermo-syphon. **Lubrication System:** Spl. pres., circulating pressure; Spl. & F. P., Splash and force feed. **Ignition:** Control. **Starting System:** West, W. Inghouse; Apico, Apico; Bif.-West, Bifur-Westinghouse; G. & D., Gray & Davis; Allis-Ch., Allis Chalmers; Stud. Wag., Studebaker Wagner; Leece-N., Leece-Neville. **Gearset Type:** S-Unit M, Selective, unit with motor; Prog. Amid., Progressive amidship; S-Unit X, Selective, unit with axle. **Driven Through:** Rad. Rod, Radius rod; Tor. tube, Torque tube. **Rear Axle:** 1/2 float, semi-floating; float, floating. **Rear springs:** B. & R., Ball and roller.

For Full Information Regarding Prices, the Seating Capacities and the Various Body Styles, See the General Indexes.

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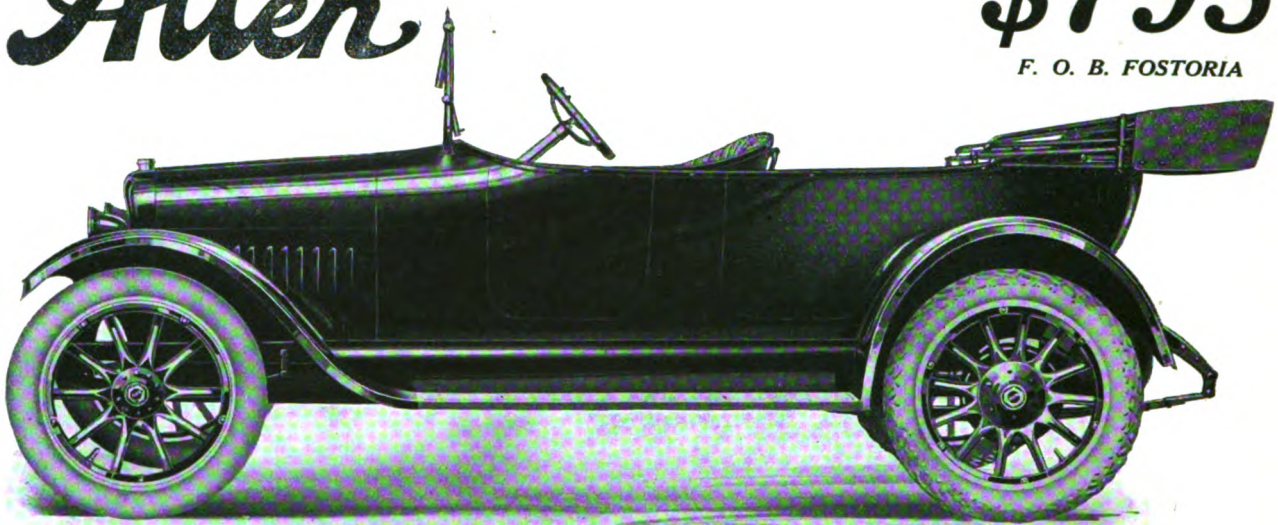


The Allen 32
\$795.
EQUIPPED

The Allen

\$795

F. O. B. FOSTORIA



STRIKINGLY BEAUTIFUL IN APPEARANCE UNUSUALLY WELL BUILT

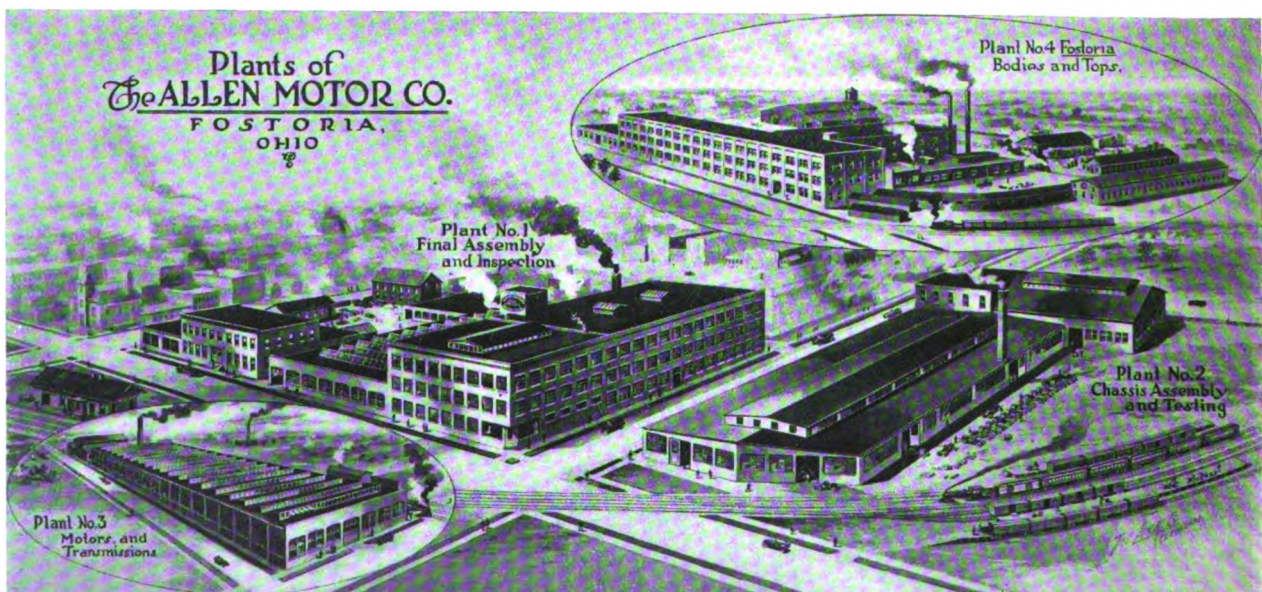
In Looks and Performance a Remarkable Value at \$795

FOR a number of seasons the Allen has been very favorably known and widely used in the West. Now it is finding ready acceptance and universal praise in the East. Dealers desiring to handle a moderate priced car with unusual selling qualities should correspond with us at an early date.

COMPARE THESE SPECIFICATIONS:

Full five passenger body—ample leg room, wide seats.
112 inch wheelbase.
Light weight—2300 lbs.
Unit Power Plant.
Long Stroke Allen-Sommer motor—perfectly balanced—full 37 H. P., 3 1/4 x 5 in.—4 cylinders.
Full floating rear axle—pressed steel housing.
55-inch underslung rear springs.
Tires 32x3 1/2 —non-skid in rear.
Westinghouse starting, lighting and ignition.
Stewart-Warner fuel feed, tank hung at rear.

(Please address reply to this ad. 1203 Allen Bldg., Fostoria, Ohio)



The Allen will be exhibited at the **Boston Show, Space 137** also at **Pittsburgh, Brooklyn and Manchester Shows.**

Tear out on perforation

SPECIFICATIONS OF 1916 TWELVE-CYLINDER GASOLINE CARS.

For Full Information Regarding Prices, the Seating Capacities and the Various Body Styles, See the General Indexes.

Make	Eager	H. A. L. Twelve	Haynes	National	Packard	Pathfinder
Model	Twin-Six	1	40 and 41	Highway 12	Twin-Six	La Salle
Bore and Stroke	2.625x3.500	2.875x5.000	2.750x5.000	2.750x4.750	3.000x5.000	2.875x5.000
H. P., S. A. E.	33.08	39.6	36.3	36.30	43.20	39.68
Piston Dia., Cu. In.	227.3	389	356.3	338.6	424.1	389.6
Cyls., Type, Cast	12-I-6	12-L-3	12-L-6	12-V-6	12-V-6	12-I-3
Make of Motor	Own	Head	Head	Own	Own	Own
Valve Location	Head	Head	Head	Outside	Inside	Head
Camshaft Drive	Chain	Spiral	Chain	Helical	Chain	Spur
Cooling System	Ther. Syph.	Pump	Pump	Pump	Pump	Pump
Lub. System	Spl. pres.	Force	Force	Pressure	Pressure	Pressure
Oil Pump	Gear	.....	Battery	Gear	Gear	Piston
Ignition System	Single	Distributor	.....	Single	Single	Single
Ignition, Control	Remy, hand	.....	Delco	Split, hand	Delco-Bijur	Delco, hand
Carburetor	Zenith	.....	Rayfield	Rayfield	Own	Stromberg
Fuel Feed	Gravity	Gravity	Vacuum	Vacuum	Pressure	Vacuum
Starting System	West.	West.	Leece-Neville	West.	Bijur	Delco
Lighting System	West.	West.	Leece-Neville	West.	Bijur	Delco
Clutch	Disc	Borg & Beck	Plate	Cone	Disc	Disc
Gearset Type	Selective	.....	S-Unit, M	Selective	Selective	Selective
Speed Ratios	Three	.....	Three	Three	Three	Three
Driven Through	Springs	.....	Springs	Springs	Springs	Springs
Rear Axle	Float.	Timken	Float.	Float.	½ float.	Float.
Direct Drive Rat.	4.75-1	4.46-1	4.77-1	4.58-1	4.35-1	4.30-1
Wheelbase	115	135	121 and 127	128	125 & 135	130
Tire Size	32x4, 32x4	34x4½, 34x4½	34x4, 34x4	36x4½, 36x4½	36x4½, 37x5	35x5, 35x5
Wheels	Wood	.....	Wire	Wood	Wood	Wire
Rear Springs	Cantilever	½ elliptic	½ elliptic	Cantilever	Plat.	½ elliptic
Drive and Control	Left, centre	Left, centre	Left, centre	Left, centre	Left	Left, centre
Eng. Main Bear.	Plain three	.....	Plain three	Plain three	Plain three	Plain
Gearset Bearings	Ball	.....	Ball	Ball	Ball	Roller
Rear Axle Bear.	B. & R.	.....	Ball duplex	Roller	Ball	Roller
Front Axle Bear.	Ball	.....	Ball	Roller	Roller	Roller

SPECIFICATIONS OF 1916 ELECTRIC PLEASURE CARS.

For Full Information Regarding Prices, the Seating Capacities and the Various Body Styles, See the General Indexes.

Make	Balley	Balley	Baker	Baker	Century	Chicago Electric
Model	.....	.....	BBD6	DA6	LB	164
Mile. Per Charge	100	90	100	100	100	75-100
Max. Speed	25 m. p. h.	25 m. p. h.	22 m. p. h.	22 m. p. h.	23 m. p. h.	25 m. p. h.
Motor Type	Series	Series	Four pole	Four pole	Series	Series
Controller Type	Drum	Drum	Con. torque	Con. torque	Magnetic	Con. torque
Speeds Forward	Six	Six	Six	Seven	Four	Five
Drive to R. W.	Chain	Chain	Worm	Worm	Bevel gear	Shaft
Rear Axle Type	Dead	Dead	Float.	Float.	Float.	Float.
Tires (Front)	33x4	33x4	34x4½, 36x4	32x4, 34x4	34	36x4½, 36x4½
Tires (Rear)	33x4	33x4	34x4½, 36x4½	32x4, 34x4	34½	36x4½, 36x4½
Steer. & Control	Lever	Lever	Lever	.....	Lever	Lever
Wheelbase	112	132	100	90	104	96
Wheels (W. or W.)	Wood	Wood	.....	.....	Wood	Opt.
Rear Springs	.....	.....	.....	.....	.....	¾ elliptic
Make	Chicago Electric	Detroit Electric	Eagle	Fritchle	Fritchle	Hupp-Yeats
Model	162 and 163	56, 57, 58, 59, 60	.....	Colonial Coupe	Colonial B'gham	3 Regent A
Mile. Per Charge	75-90	50-85	75	75-100	60-90	50-75
Max. Speed	22 m. p. h.	22 m. p. h.	22 m. p. h.	20 m. p. h.	20 m. p. h.	16 m. p. h.
Motor Type	Series	Series	Series	Compound	Compound	Series
Controller Type	Con. torque	Drum	Drum	Drum	Drum	Barrel
Speeds Forward	Five	Five	Four	Five	Five	Four
Drive to R. W.	Shaft	Worm	Worm	Worm	Worm	Worm
Rear Axle Type	Float.	Float.	½ float.	½ float.	½ float.	½ float.
Tires (Front)	36x4½, 34x4½	34x4½ or 36x4½	32x3½	34x3½	34x4	32x3½
Tires (Rear)	36x4½, 34x4½	34x4½ or 36x4½	32x3½	34x3½	34x4	33x4
Steer. & Control	Lever	Lever	Lever	Lever	Lever	Lever
Wheelbase	104	100	110	94	102	86
Wheels (W. or W.)	Opt.	Opt.	Wood	Wood	Wood	Wood
Rear Springs	¾ elliptic	Elliptic	.....	Elliptic	Full elliptic	¾ elliptic
Make	Hupp-Yeats	Hupp-Yeats	Ohio	Ohio	Rauch & Lang	Rauch & Lang
Model	4 Regent B	5 Patrician	42 & 62	12	J6, R6, CR6, BX6	TC6, TXC6
Mile. Per Charge	75-90	90-100	60-85	60-85	100	100
Max. Speed	16 m. p. h.	16 m. p. h.	25 m. p. h.	23 m. p. h.	26 m. p. h.	23 m. p. h.
Motor Type	Series	Series	Series	Series	Compound	Compound
Controller Type	Barrel	Barrel	Magnetic	Magnetic	Flat	Flat
Speeds Forward	Four	Four	Five	Five	Six	Six
Drive to R. W.	Worm	Worm	Worm	Worm	Worm	Worm
Rear Axle Type	½ float.	½ float.	Float.	Float.	Float.	Float.
Tires (Front)	33x4	33x4	34x4½, 36x4	34x4, 36x4	33x4½, 36x4	33x4½, 36x4½
Tires (Rear)	33x4	33x4	34x4½, 36x4	34x4, 36x4	33x4½, 36x4	33x4½, 36x4½
Steer. & Control	Lever	Lever	Lever	Lever	Lever	Lever
Wheelbase	86	100	98½	96	92 and 102	109
Wheels (W. or W.)	Wood	Wood	Opt.	Opt.	.....	.....
Rear Springs	¾ elliptic	¾ elliptic	¾ elliptic	¾ elliptic	.....	.....

ABBREVIATIONS—Cyls., Type, Cast: Cyls., total number; Type, shape of motor; Cast, pairs, fours, sixes or eights. **Make of Motor:** Hersch-Spill, Hersch-Spillman; G. B. S., Golden, Belknap & Swartz; Rut. Beav., Rutenber & Beaver. **Valve Location:** R. & H., Right and Head; Knight, Knight Sleeve Type; In V, in alloy of an eight or 12. **Cooling Systems:** Ther. Syph., Thermo-syphon. **Lubrication System:** Spl. pres., Splash and pressure; Cir. pres., circulating pressure; Spl., & F. F., Splash and force feed. **Ignition Control:** Ignition, Conn., Connecticut; West., Westinghouse; At-Kent, Atwater-Kent; Split., Split-dorf; Control, H. & A., Hand and automatic; At., automatic. **Starting System:** West., Westinghouse; Aplco, Apelco; Bij. West., Bijur-Westinghouse; G. & D., Gray & Davis; Allis-Ch., Allis Chalmers; Stud. Wag., Studebaker Wagner; Leece-N., Leece-Neville. **Gearset Type:** S-Unit M, Selective, unit with motor; Prog. Amid., Progressive amidship; S-Unit X, Selective, unit with axle. **Driven Through:** Rad. Rod, Radius rod; Tor. tube, Torque tube. **Rear Axle:** ½ float, semi-floating; float, floating. **Rear Springs:** Plat., Platform. **Bearings:** B. & R., Ball and roller.

MOTORS AT SAN DIEGO EXPOSITION.

THE Panama-California International Exposition, which will continue through the present year, and be much enlarged and improved, will have much of interest for motorists. There is to be no show of the ordinary type and no exhibits or medals. However, tests of various kinds for motor vehicles are being arranged.

Automobiles will be admitted to the grounds and will be provided with parking space for 24 hours at a cost of 25 cents. Those who drive more than 500 miles to the exposition will be provided with a special button to announce the fact to the public.

Among the special motor events will be demonstrations of all cars selling for less than \$750, another for cars from \$600 to \$1200 and third for the highest priced cars made. There will be days for roadsters, trucks and touring cars and special days will be assigned to particular makes of cars.

Blythe H. Henderson, chief of transportation of the San Francisco exposition, will be in charge. W. E. Benton, who had charge of the motor exhibit at that exposition, will be his assistant.

Travel by motor car to California is expected to be much greater this year than last. El Camino real, the concrete highway which extends almost the whole length of the state, has been completed between San Diego and Los Angeles. There are many wonderful drives. The Pacific Reserve fleet will be kept all summer at the exposition. The government aviation school will be another attraction.

BILL FOR NATIONAL DEFENSE ROAD.

A bill has been introduced in the House of Representatives by William D. Stephens for the construction of a road for national defense purposes and to extend completely around the borders of the United States. This bill is known as house bill 3667.

It calls for the employment of 100,000 men on the road in busy times and of a much greater number in times of depression. It further provides that the force so employed shall devote two hours every day to military drill under United States army officers and that only those men who are of military age be given employment.

The road is to be strictly a Federal undertaking and the states through which it passes may be asked to turn over long stretches of all ready constructed roads to the government for maintenance as a part of the defense highway. The road starts east from San Diego through Arizona and Texas and follows the gulf coast to Florida, where it turns north along the Atlantic coast through Washington to New York and thence up the Hudson and through Massachusetts to Boston. It goes east from New York through Chicago, Minneapolis and to Seattle, and thence south along the Pacific coast to San Diego.

The proposal is made that it be financed by an issue of \$100,000,000 of government bonds to be sold at three per cent. interest in small denominations and

that in disposing of it the smaller subscriptions be taken care of first.

This road would be open in times of peace to all sorts of vehicles for any use under regulations to be formulated by the President and the specifications for its construction should also be determined by him.

THE ENGLISH QUANTITY CAR.

Discussion of quantity car production in England as the only means of meeting the competition of the American makers has been a feature in the English trade press for many months. Many plans have been offered, some of them based on the assembling system. One suggestion is that each of the established manufacturers, in addition to his regular production, turn out one component of another car to be assembled in a separate plant. The various companies would share equally in the stock ownership of the new company and receive a part of the profits. Another plan is to form a single large company, like the Ford, to make a cheaper car than has hitherto been produced in England.

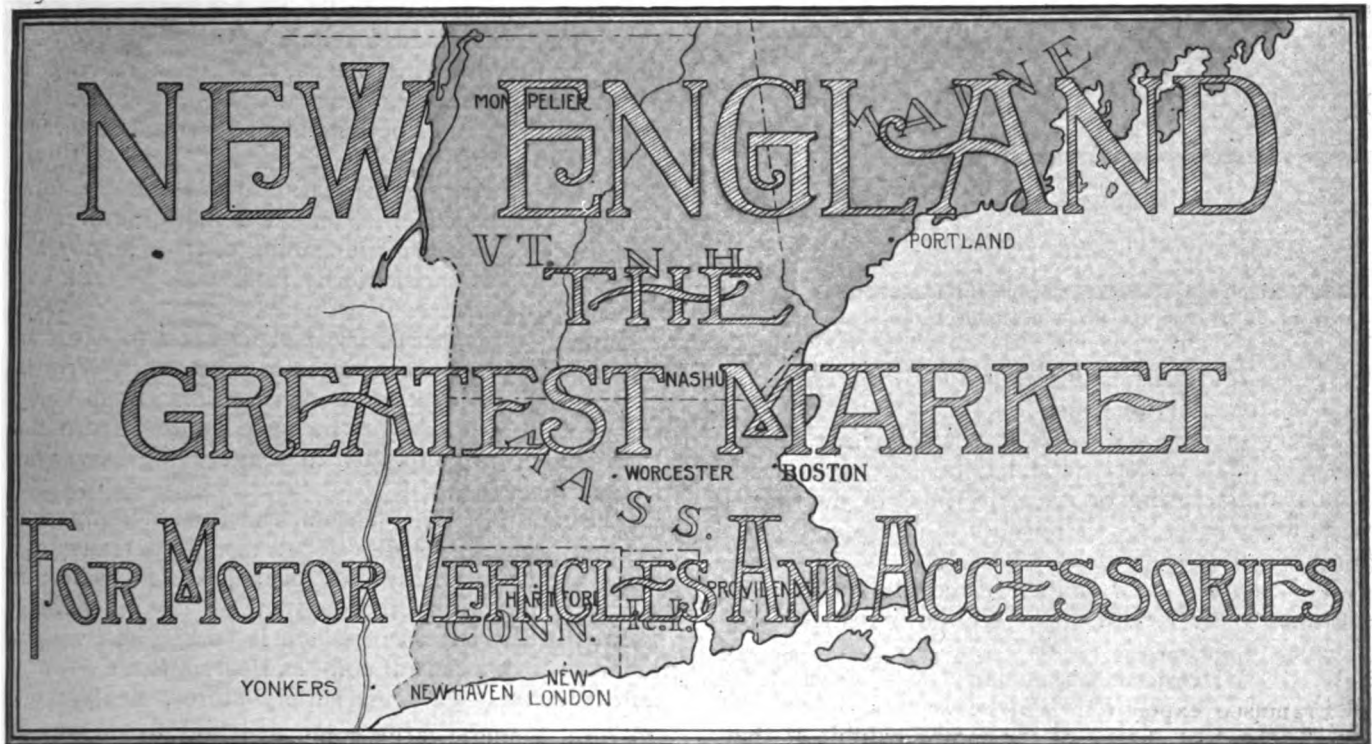
The discussion seems to be more interesting to motorists and amateurs than the English manufacturers, who cannot see how England would be able to sell a large volume of production if the car were built. The United States has a tremendous home market, which absorbs great outputs—in fact, about three-fourths of the cars in the world are in the United States. So at best the English, who cannot get through the American tariff wall, will have only a quarter of the market to sell in, and they would be excluded from much of that by other tariff barriers.

TEST SHOWS MANUFACTURING PROGRESS.

There have been slight changes in design in the standard four-cylinder cars since 1912, but there has been tremendous progress on the manufacturing side. In 1912 a car weighing 2600 pounds and costing \$1500 made a non-stop run of 12,404.9 miles and stopped when the engine quit in need of repairs. A 1916 Maxwell car, weighing 1950 pounds, ran 22,022.3 without stopping the motor and was still in condition to go further. The car is sold for \$655 and it made 22 miles per gallon of gasoline against 13 miles for the older car. This indicates what improved methods of production have done for the buyer.

FREE ENTRY OF CARS TO PARAGUAY.

To encourage importation of vehicles into Paraguay, a recent law provides that unused vehicles, including motor cars and trucks, as well as spare parts, can be brought into the country free of duty for two years. The suspended duty amounts to 62 per cent. ad valorem and surtaxes. A law exempting motor vehicles had been in force for one year and this act extends it for two years more.



NEW ENGLAND is, and has been since the beginning of the motor vehicle industry, one of America's greatest markets for automobiles, motor trucks and accessories. This fact has never been more evident than at this time, as is shown by the activity of the dealers in Boston, the great distributing centre of the section.

Competent authorities declare that many manufacturers of motor vehicles do nearly as much business through their Boston branches and other selling channels as they do through their New York City connections. There are some companies, particularly those which produce high priced cars, whose greatest volume of distribution is through the New England metropolis.

The importance of the New England market is shown by the relatively large number of cars it absorbed during last year. Registration figures, as reported in the six states on Jan. 1, 1915, and the corresponding day of 1916, show that 50,512 pleasure cars and commercial trucks were purchased during 1915. This is remarkable in view of the extreme business depression by which the business and the people of the district were affected during the first eight or nine months of that period.

In recent months, however, normal prosperity has been restored, which is evident in the great activity of practically all lines of business. This is particularly noticeable among concerns engaged in filling war orders, of which New England has had a very large share. As spring approaches there are numerous indications that business will continue to improve and that it will be better than it ever has been.

That sales of motor vehicles in 1916 will be 25 per cent. greater than during 1915 is generally considered to a conservative estimate. One factor contributing to the increase is that the market has been expanded by cars being offered at prices which are lower than formerly. If such an increase is made it will mean that dealers in New England will dispose of approximately 63,000 automobiles, motor trucks and a proportionate-

ly increased volume of accessories.

The following table shows how sales were distributed among the New England states last year, and indicates, in a general way, which localities will buy the most cars this year:

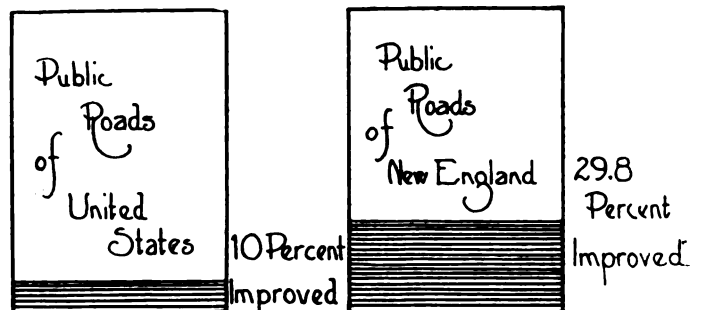
Registrations of Motor Vehicles.

	1915	1914	Gain
Maine	21,539	16,028	5,511
New Hampshire	14,915	10,596	4,319
Vermont	10,895	8,254	2,641
Massachusetts	102,633	77,246	25,387
Rhode Island	16,362	13,058	3,304
Connecticut	38,721	29,371	9,350
Totals.....	205,065	154,553	50,512

Many factors contribute to making New England the motoring centre it has always been. It is one of the wealthiest and most highly developed industrial sections. Its capitalists not only own the great New England industrial plants, but they have in all parts of the United States investments which yield very satisfactory incomes.

Income Tax Shows Wealth.

Concrete evidence that this wealth is greater than is possessed by most sections of the country is the fact that in 1915 the population of New England, which is 6.8 per cent. of that of the United States, according to-



New England Roads Are the Best in the Country—29.8 Per Cent. Are Surfaced Against 10 Per Cent. the Country Over.

Per Capita Payment of Individual Income Tax

U S As a Whole 41 Cents

New England 60 Cents

The Value of Its Manufactured Products Is \$182 for Every Inhabitant Against \$93 the Country Over.

the census bureau's estimates, paid 10 per cent. of the total federal individual income tax.

Every income tax payer in these days is a "live" prospect for a motor car and if his income is drawn from manufacturing or its many lines of distribution he, in many cases, is in a position to influence the total purchases of motor trucks.

This table of New England's income tax payments shows how the wealth of the section is distributed:

State	Income Tax Payment, 1915.	State	Income Tax Payment 1915.
Maine	\$150,094.51	Massachusetts	2,683,084.53
New Hampshire..	71,023.29	Rhode Island.....	432,453.37
Vermont	141,428.77	Connecticut	648,891.26
Total.....			\$4,126,975.73

This evidence of wealth makes apparent the reason why New England is so active a market for high-grade and medium priced cars. It offers an enormous field also for low priced motor vehicles.

Good Roads Help Motors.

Another reason for the early development of the motor industry in New England is the excellent condition of the highways there. It has always had better roads than any other section and since the beginning of the era of state aid in the improvement of highways, no other has done so much toward perfecting them.

Thus, while only 10 per cent. of the total public roads in the United States are surfaced and improved, New England has an average of 29.8 per cent. of such highways. They are located as follows:

State	Public Roads	Improved	Per Cent.
Maine	25,528 miles	3,264 miles	12.8
New Hampshire.....	15,116 miles	1,025 miles	6.8
Vermont	15,082 miles	3,278 miles	22.7
Massachusetts	17,272 miles	8,928 miles	51.7
Rhode Island.....	2,121 miles	1,246 miles	58.8
Connecticut	12,582 miles	3,300 miles	26.2

In addition to encouraging New England residents to own and operate motor cars, these excellent roads, in connection with the mountain coast and river scenery, have another effect on the section as a motor market, which is of importance to those who deal in accessories and supplies or who provide service. They attract thousands of car owners from all parts of the country to tour through New England during the summer. Probably no section, not even California, has so many visitors who travel by motor car. These tourists are largely responsible for a great expansion in the business of the New England garages and supply stores during the summer time.

There is no territory in the United States where so large a market as New England can be found so compactly arranged. This makes it very attractive to manufacturers seeking representation, because that representation can be obtained more easily and cheaply than elsewhere.

With a central service station in Boston the entire territory can be covered, and if a manufacturer has good representation in the leading centres it may also be taken care of satisfactorily from a New York City branch headquarters.

Supply stores, accessory distributors and hardware dealers are already in business in practically every locality. The machinery for distribution exists everywhere and it needs only to be made use of—a situation that is much different than in some of the newer districts in the West.

The density of population, the towns being close together and the well developed means of transportation make it both easy and inexpensive for salesmen to cover the territory thoroughly.

In this district, all of which is within half a day's ride from such a central point as Boston, there are 3589 trade interests—garages, supply stores, dealers and similar concerns. These are distributed among the states as follows:

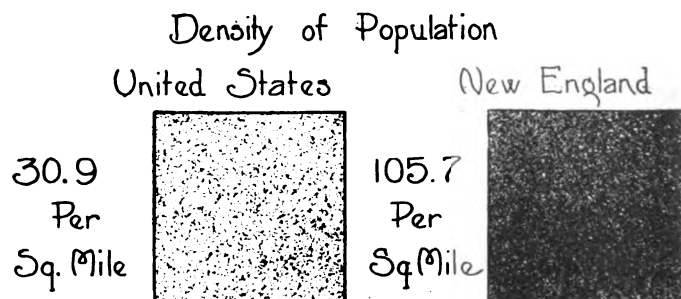
Maine	338	Massachusetts	1818
New Hampshire.....	355	Rhode Island.....	238
Vermont	214	Connecticut	626
Total.....			3589

In no section of the country, with the exception of the Middle Atlantic states, including New York, New Jersey and Pennsylvania, is manufacturing so highly developed as it is in New England. There were, when the last Federal census was taken, 25,351 manufacturing establishments in New England, and they employed 1,101,290 wage earners, who turned out products valued at \$2,670,065,114, of which \$1,193,768,236 was value added by manufacture.

Summary of Manufactures.

The value of the manufactured products of the section per capita amounted to \$480, while for the whole United States it amounted to only \$225. Similarly the value added to products by manufacture in the New England mills was \$182 per capita, as against \$93 for the country as a whole. Of the population 16.8 per cent. are industrial workers, as compared to 7.2 per cent. for the whole United States. New England produces 12½ per cent. of the country's manufactured products.

The following summary shows the distribution of New England industries as given in the latest avail-



It is One of the Most Densely Populated Sections, with 105.7 Persons to the Square Mile Against 30.9 for United States.

New England's Population and Manufactures

Population of
New England
6.8 Percent of
United States

Manufactures
of New England
12½ Percent
of United States



It is a Great Manufacturing Centre—With 6.8 Per Cent. of the People It Makes 12½ Per Cent. of the Manufactures of the United States.

able records. There has of course been much growth in the last year, and the large war business has helped to produce an era of unexampled expansion:

State	No. of Ind.	No. of Estab.	Employees	Value of Products
Maine	126	3,546	79,955	\$176,029,393
New Hampshire.....	104	1,961	78,658	164,581,019
Vermont	84	1,958	33,788	68,309,824
Massachusetts	223	11,684	584,559	1,490,529,386
Rhode Island	135	1,951	113,538	280,343,797
Connecticut	188	4,251	210,792	490,271,695

The importance of the manufacturing industries is shown by the collections of Federal corporation income tax, which show that here again New England's exceptional productiveness enabled it to pay a greater proportion of the tax than the rest of the country. The 6.8 per cent. of the United States population living in New England paid 8.3 per cent. of the corporation income tax. The tax was divided as follows:

State	Corp. Tax Payment, 1915.	State	Corp. Tax Payment, 1915.
Maine	\$325,168.99	Massachusetts	1,853,057.41
New Hampshire....	96,944.33	Rhode Island.....	278,658.26
Vermont	53,645.86	Connecticut	634,804.71
Total.....			\$3,242,279.56

The order in which the lines of manufacture are of importance in the various states is as follows:

Connecticut: Brass and bronze articles, foundry and machine shop products, cotton goods, silk and firearms.

Maine: Paper, wood pulp, lumber, cotton and woolen goods, boots and shoes.

Massachusetts: Boots and shoes, cotton and woolen goods, foundry and machine shop products, printing and publishing.

New Hampshire: Boots and shoes, cotton and woolen goods, lumber, paper and wood pulp.

Rhode Island: Woolen and cotton goods, jewelry, foundry and machine shop products, dyeing and finishing textiles.

Vermont: Marble and stone work, lumber and timber, butter, cheese, condensed milk and dairy products, woolen goods and flour.

With few exceptions motor trucks are already employed in these industries and there is room for thousands more, which are certain to be purchased.

New England is very thickly settled, in fact, three times as much as that of the United States as a whole. In 1910 there were 105.7 persons to the square mile, as compared with the average of 30.9 in all the United

States. According to the census bureau's estimate for Jan. 1, 1916, this population is divided in this way:

Maine	770,064	Massachusetts	3,690,748
New Hampshire.....	441,545	Rhode Island.....	608,540
Vermont	363,075	Connecticut	1,234,031
Total.....			7,108,003

This density of population has much significance for the motor vehicle trade. It represents a tremendous power of consumption and consequently makes necessary a very large wholesale and retail distributing business. Furthermore, it means that the towns are very close together, and that even between them the country is quite thickly settled.

In such a state as Rhode Island, for instance, there is hardly a neighborhood in the country, in the city, or in the small towns where deliveries are not made directly by the department stores and markets of Providence. And where on the north and east, well into Massachusetts, the Providence delivery limits end, those of Boston begin.

This long distance delivery is made possible by the fact that there is enough of it to make it pay, and, of course, the motor vehicle is the only type with which it is practicable to make such deliveries.

Much Interurban Hauling.

Furthermore, the closeness of the towns and the speed of truck service, as compared with railroad freighting, or even express service, has caused the development of a great number of interurban motor express companies, which regularly carry supplies from the metropolitan jobbers to the small town retailers. By these lines a net work is rapidly being formed to serve all of the industrial sections of New England.

The excellent roads make it possible and easy to move furniture and similar bulky goods over long distances by motor truck. The railroads have been losing more of that business every year.

Another condition that is favorable to motor trucking is the fact that the railroads were able to confine the trolley lines to local service. Consequently that share of freight and express business not done by the railroads is handled by motor trucks. And the proportion is large. Passenger 'bus lines are developing in many localities where the local trolley service has not been established, and it is probable that these "jitney" lines have an excellent future in New England.

Less Horses in Industry.

The government live stock report of Jan. 1, 1916, shows that there are more horses in New England than there were five years ago and that their average value is higher. But the important point for the motor industry is that the number of horses has greatly fallen.

Per Capita Value Added By Manufacture

United States As a Whole \$93

New England \$182

New England is Unusually Wealthy—Its 6.8 Per Cent. of the People Pay 10 Per Cent. of the Individual Income Tax.

off in the industrial sections. The increase is entirely in Maine, New Hampshire and Vermont, which are agricultural states.

The figures show that there are now 366,000 horses in New England as compared to 358,000 five years ago. Their average value in 1911 was \$133.50, while at present they are worth \$141.11. Maine shows a gain of 3000, Vermont of 7000 and New Hampshire of 1000.

Connecticut, Massachusetts and Rhode Island each show a decrease of 1000 horses from the number they had five years ago. There undeniably has been a large growth in business in these states in five years and much more material is moved over the streets and roads than was moved five years ago.

Presumably the cause for the reduced number of horses is that the number of motor cars and trucks has increased. Unlike the western agricultural states, farming in New England has not been greatly affected by the development of the motor car and more particularly the motor truck.

While the large western farmers are exhibiting an interest in the motor truck as a means of transporting their produce to market, the individual farms of New England, excepting some large dairies and market gardening establishments in the neighborhood of the large cities, are too small for profitable use of motor trucks.

A movement is developing to consolidate many of these small farms into larger units. Also there has been a noticeable movement of the large scale western farmers toward locating in the East, to be nearer to the larger markets. This is a promise of a market for trucks and motor farm machinery for the future.

WINTON OFFERS MANY CHOICES.

To permit buyers to obtain the utmost in individuality of finish, upholstery and fittings, the Winton company is offering no less than 1290 different combinations in its cars. There are 36 body designs, 72 color suggestions, five styles of leathers for upholstery and innumerable patterns of fabrics.

The company has no "standard" treatment, but allows its patrons to make selections to please their individual tastes.

STUTZ OUT OF RACING.

Harry Stutz, president of the Stutz Motor Car Company, Indianapolis, denies that Stutz cars will be represented in the big races this year. His car will be kept out until its record is equalled or beaten and only then will he re-enter racing.

Earl Cooper has arranged to drive the Stutz car he had in 1915 in a few races in the West in the spring, but he will not race in the East. The statement he made after the Sheepshead Bay race will stand, said Mr. Stutz.

TWO MILLION IN REGISTRATION FEES.

Growth of the number of automobiles in Connecticut is shown by figures on registrations issued each

year since Sept. 30, 1908. In that year the fees collected amounted to \$61,747.50, while for 1915 they were \$536,970.09.

The following table shows how this growth has progressed:

Year	Registrations	Fees	Year	Registrations	Fees
1908....	7,895	\$61,747.50	1912....	21,371	\$255,124.06
1909....	10,000	58,534.65	1913....	26,560	\$320,796.52
1910....	11,789	162,275.10	1914....	32,790	406,623.34
1911....	16,372	230,120.89	1915....	42,260	536,970.09

MOTORS SUPPLANT SUBURBAN SERVICE.

The inroads which the motor car, motor 'bus and trolley systems are making on the suburban passenger business of the railroads was revealed recently in a case brought before the New York State Public Service Commission by the residents of some towns on the Lehigh Valley road, to cause the installation of additional suburban trains.

The commission held that the convenience to the public of the extra trains was evident, but that the railroad had shown that the trains in operation scarcely did business enough to pay expenses and that if more were added they would have to be operated at a loss.

"The familiar local train," says the writer of the opinion, "composed of locomotive, baggage, express car and one or two coaches, is in a state of obsolescence. Such trains carry only those passengers who have no other means of transportation. Some cheaper, faster and more comfortable means of transportation must be secured or else the railroads must continue to operate them at a loss in spite of economies and curtailments of service."

This state of affairs the commission attributed largely to the development of the motor car, which a few years ago was the toy of the rich man for a few months in the summer, but which is now the convenient passenger and freight vehicle of almost all people.

The gasoline driven railroad car is suggested as a possible solution of the difficulty of the roads. These had been tried and been found successful, he said, but the trial had not been continued to the point where the cost of depreciation was determined. He expressed the opinion that the railroads had shown a lack of enterprise in solving their difficulty.

AID TOURISTS ENTERING CANADA.

Some time ago the Board of Trade at Sherbrooke, Que., secured from the Canadian customs department permission for United States tourists to enter Canada without bond for the duty on their automobiles. Arrangements have now been made on the initiative of the Eastern Townships Associated Board of Trade, of which Sherbrooke is the centre, to have the department give service to tourists until midnight at the ports of Rock Island, Stanhope and possibly Mansonville, which are the points through which most United States tourists enter this section of Canada. This will do away with the inconvenience that was often experienced when customs officers left their duties at sunset.

BOSTON'S BIG NATIONAL MOTOR VEHICLE SHOW.

The Complete List of Exhibitors Presented Here Indicates that the Fourteenth Annual Display Will Be the Largest Ever Held in Mechanics' Building.

THE doors of Mechanics building, Huntington avenue, Boston, will be thrown open to visitors early in the afternoon of Saturday, March 4, and except for the following Sunday, will remain open until Saturday evening of March 11, from 10 a. m. until 10:30 p. m.

This plan of hours was inaugurated last year to afford thousands of out of town motorists opportunity to attend and also to relieve the congestion that has been so noticeable at former exhibitions.

The exhibits have been well departmentized. The main floor will be given over generally to the display of pleasure cars, the basement to commercial vehicles and accessories, and the galleries of Grand, Machinery and Paul Revere halls to accessories exclusively. Many of the regular exhibitors will be found at the booths they occupied last year, which is a decided advantage both to the visitors and the dealers.

Following precedent, Wednesday, March 15, will be society and governor's day. On all days nationally known orchestras will entertain visitors with their music. The musical programme has been one of the chief features of Boston shows for years and this year the selections will prove no exception. It is expected that the Boston Philharmonic and the Laura L. Archambault woman's orchestras will be engaged for the week.

There has been a tremendous demand for reservations by manufacturers and dealers, and a large number have been, perforce, refused. The following tabulation shows spaces exhibitors will occupy:

A.

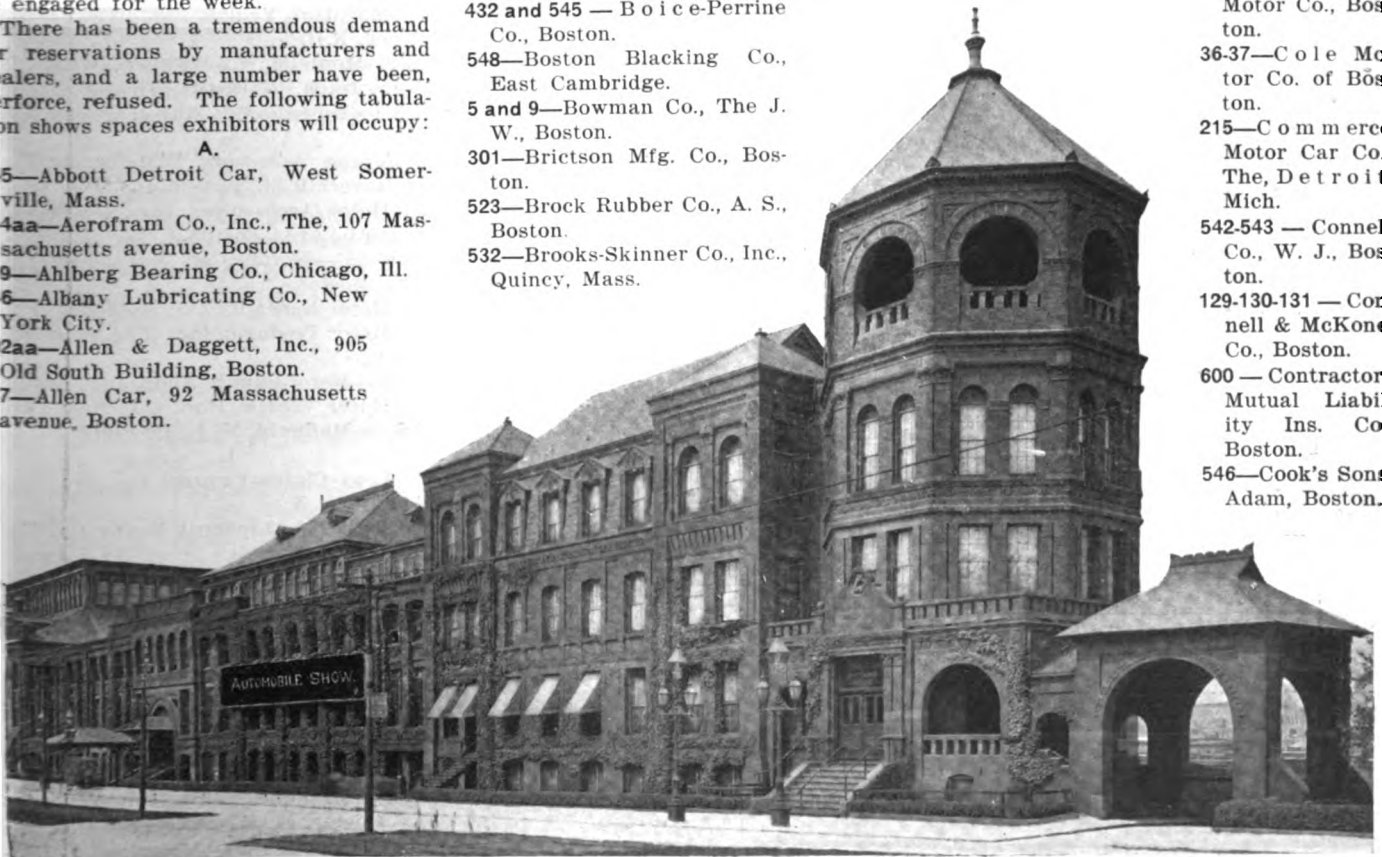
- 145—Abbott Detroit Car, West Somerville, Mass.
- 444aa—Aerofram Co., Inc., The, 107 Massachusetts avenue, Boston.
- 549—Ahlberg Bearing Co., Chicago, Ill.
- 546—Albany Lubricating Co., New York City.
- 602aa—Allen & Daggett, Inc., 905 Old South Building, Boston.
- 137—Allen Car, 92 Massachusetts avenue, Boston.

- 429—American Express Co., Boston.
- 443—American Storage Battery Co., Cambridge, Mass.
- 32—Anthony, F. P., 1094 Commonwealth avenue, Boston.
- 132—Apperson Car, Boston.
- 354-355—Argo Sales Co., Inc., Boston.
- 100aa—Atlantic Auto Co., Boston.
- 501—Atwood Auto Lamp Co., Boston.
- 619—Atwood, J. H. & G. L., Boston.
- 427-428 Sp.—Auburn Car, 92 Massachusetts avenue, Boston.
- 408—Auto Parts Co., Boston.
- 319-320-323-324-336-337—Autocar Sales and Service Co., Boston.
- 303—Automatic Time Stamp Co., Boston.
- The Automobile Journal Publishing Company, Pawtucket R. I.
- 536-537—Automobile Legal Association, Boston.
- 514—Automobile Dealer and Repairer, New York City.

B.

- 310-311-312—Baker Motor Sales Co., Inc., Cambridge, Mass.
- 304—Bay State Transportation Co., Fall River, Mass.
- 14 and 18—Beacon Motor Car Co., Boston.
- 100—Becker-Stutz Auto Co., Boston.
- 352-353—Bell Motor Sales Co., Boston.
- 413—Benn Pump Works, Inc., Boston.
- 400—Bird & Co., J. A. & W., Boston.
- 212-213—Bishop Motor Sales Co., Boston.
- 432 and 545—Boice-Perrine Co., Boston.
- 548—Boston Blacking Co., East Cambridge.
- 5 and 9—Bowman Co., The J. W., Boston.
- 301—Britson Mfg. Co., Boston.
- 523—Brock Rubber Co., A. S., Boston.
- 532—Brooks-Skinner Co., Inc., Quincy, Mass.

- 604—Brown Spring Oiler Co., Cleveland, O.
- 111a-112—Briscoe Car, Boston.
- 140-144 inc.—Buick Boston Co., Boston.
- 226—Buick Trucks, 15 Lawton St., Boston.
- 441—Burd King Sales Co., Buffalo, N. Y. C.
- 135a-136—Carter, Fred C., Cambridge, Mass.
- 2—Cadillac Auto Co. of Boston, Boston.
- 540—Caldwell, John, Boston.
- 557—Campbell Co., A. S., Boston.
- 101—Canterbury, Inc., George W., Boston.
- 359-364 incl.—Cape Cod Power Dory Co., Wareham, Mass.
- 420—Central Auto Tire Co., Boston
- 108-109—Chalmers Motor Co. of Massachusetts, Boston.
- 434—Champion Spark Plug Co., Toledo, O.
- 22 and 23—Chandler Motors of N. E., Inc., Boston.
- 111a-112—Charles Motor Co., 25 Irvington St., Boston.
- 3 and 132—Chase, Inc., M. F., Boston.
- 247—Chase Motor Truck Co., Syracuse, N. Y.
- 611—Cherry, Inc., A. C., 819 Boylston St., Boston.
- 121a-122—Chevrolet Motor Co. of N. E., Boston.
- 134aa—Class Journal Co., The, New York.
- 308-451-452-453—C o b u r n - D r a p e r Motor Co., Boston.
- 36-37—Cole Motor Co. of Boston.
- 215—Commerce Motor Car Co., The, Detroit, Mich.
- 542-543—Connell Co., W. J., Boston.
- 129-130-131—Connell & McKone, Co., Boston.
- 600—Contractors Mutual Liability Ins. Co., Boston.
- 546—Cook's Sons, Adam, Boston.



Mechanics' Building, the Scene of the 14th Annual Boston Show, Which Is Expected to Break All Records.

331-334 incl.—Cotton, Inc., L. M., Boston.
 520-521—Coward Auto Supply Co., Boston.
 138 and 313—Cunningham Son & Co., Jas., Boston.
 302—Cut Price Auto Supply Co., Boston.
 358—Cygnet Rear Car Co., Buffalo, N. Y.

D.

5 and 9—Daniels Car, Boston.
 601—Davis-Watson Mfg. Co., Nashua, N. H.
 524-525—Dayton Tire Co., The, Boston.
 200—Denby Motor Truck Co., Detroit, Mich.
 300—Detroit Auto Products Co., Detroit, Mich.
 33—Detroit Electric, Boston.
 424-425—Detroit Car, 911 Boylston St., Boston.
 201—Diamond T. Motor Truck Co. of N. Y., New York City.
 146-147—Dodge Bros. Car, Boston.
 123-124—Donovan Motor Car Co., Boston.
 411—Dorsey Mfg. Co., Boston.
 115-116—Dort Car, Boston.
 139 and 145—Dutton Motor Co., Inc., F. A., West Somerville, Mass.
 530—Dyer Co., The G. H., Cambridge, Mass.
 424-425—Detroit Car, Boston.

E.

541—Eagle Oil and Supply Co., Boston.
 526-527—Eastern Oil Tank Co., Lowell, Mass.
 554—Eisner-Lenk Co., The, Boston.
 139 and 145—Empire Car, West Somerville, Mass.
 423a—Evans Carburetor Co., Inc., New York City.

F.

113-114—Fiat Motor Sales Co., Boston.
 511—Flentje, Ernst, Cambridge, Mass.
 328-329a-620-621—Forbes, Walter J., Boston.
 117-118—Ford Motor Co., Cambridge, Mass.
 414—Ford Co., Percy, Boston.

217—Fostoria Light Car Co., Fostoria, O.
 121b-127a-128—Franklin Motor Car Co., Boston.

505-506—Fryer-Auster Co., Providence, R. I.
 513—Fuller Brush Co., The, Hartford, Conn.

G.

219-220-221—Garford Truck, Boston.
 317 and 321—General Vehicle Co., Inc., Long Island City, N. Y.
 602—Gordon Tire and Rubber Co., Canton, O.
 240-241—Grant Car, Boston.
 507-508—Green & Swett, Boston.

H.

305—Hardenbrook & Co., W. L., Boston.
 544—Harding Manufacturing Co., Boston.
 311aa—Harding, W. A., Boston.
 401—Harnett-Smith Co., Boston.
 26-27-28—Hart Co., A. T., Boston.
 218—Harwood-Barley Mfg. Co., Marion, Ind.
 38—Haynes Car, Boston.
 338-345—Henderson Bros., North Cambridge, Mass.
 125-126-127b—Henley-Kimball Co., The, Boston.
 146-147—Henshaw Motor Co., Boston.
 135a-136—Herff-Brooks Corporation, Indianapolis, Ind.
 436—Hill Smith Metal Goods Co., Boston.
 446—Hillman Auto Supply Co., Boston.
 424-425—Hollier Motor Sales Co., Boston.
 502—Holt & Beebe Co., Boston.
 603—Howe Rubber Co., New Brunswick, N. J.
 125-126-127—Hudson Car, Boston.
 100aa—Hupmobile Car, Boston.

I.

222-223—International Harvester Co. of America, Somerville, Mass.
 218—Indiana Truck, Marion, Ind.
 111a-112—Interstate Car, Boston.

J.

608—Jackson, Charles A., Boston.
 35—Jackson Motor Car Co., Boston.
 105-106-107-325—Jeffery Cars and Trucks, Boston.
 601aa—Johnson Sporting Goods Co., Iver, 155 Washington St., Boston.
 137—Judd, John L., Boston.
 442—Justice Co., A. R., Philadelphia, Penn.

K.

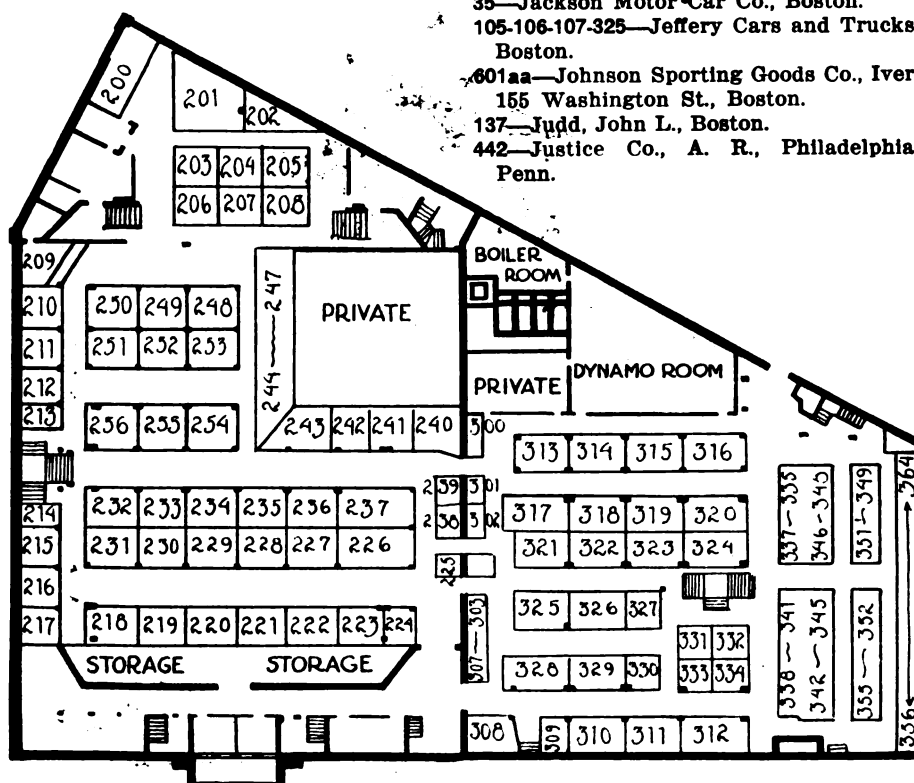
503 and 607—Keating & Decker, Newton, Mass.
 556—Kelleher Co., J. J., Dorchester, Mass.
 315 and 316—Kelly-Springfield Motor Truck Co., The, Boston.
 613—Keys Piston Ring Co., St. Louis, Mo.
 522—Keystone Lubricating Co., Boston.
 134-135b—King Motor Car N. E. Agency, Boston.
 34 and 104—KisselKar, N. E. Branch, Boston.
 314—Knox Motors Associates, 32 Green St., Cambridge, Mass.
 254-255-256—Kress & Son, O. F., Lawrence, Mass.
 614—Mann Co., F. W., Milford, Mass.
 524-525—Marathon Tire Co., The, Boston.
 8 and 12—Marmon Car, Boston.
 133—Marion Car, Boston.
 238-239—Martin Rocking Fifth Wheel Co., Springfield, Mass.
 610—Marvel Mist Mfg. Co., Inc., Brooklyn, N. Y.
 427-428 Sp.—Massachusetts Motor Sales Co., 92 Massachusetts Ave., Boston.
 538-539—Massachusetts Mutual Auto Insurance Co., Boston.
 403—Master Carburetor Sales Co., Boston.
 308-451-452-453—Maxwell Car and Trucks, Boston.
 32—McFarlan Six Cars, 1094 Commonwealth Ave., Boston.
 500—Mead, J. Herbert, Boston.
 318 and 322—Menominee Truck, Boston.
 110-111b-242—Metz Company, Boston.
 Table—Meyers Bros., Bronx, N. Y.
 435—Miller, Charles E., Boston.
 416-417—Mitchell & Smith, Inc., Boston.
 354-355—Moline Knight Car, Boston.
 Paul Revere Hall—Mitchell Car, Boston.
 33—Milburn Electric, Boston.
 202—Monahan Vehicle Co., The, Providence, R. I.
 Table—Montello, V., Medford, Mass.
 418—Moreton, Walter H., Boston.
 102-103—Morse, & Co., Alfred Cutler, Boston.
 625—Motor Accessory Distributing Co., 86 Haverhill St., Boston.
 624—Motor Accessories, Inc., 165 Massachusetts Ave., Boston.
 450-550-551—Motor Car Equipment Co., The, Boston.
 500—Motor Necessity Co., Boston.
 618—Motor Products, Inc., The, Stamford, Conn.
 447-448—Motor Supply Shop, Inc., Boston.
 514—Motor Vehicle Pub. Co., New York.
 602-603—Mulherin, V. J., Boston.

L.

406—Lewi Clutch Control Co., Inc., The, Albany, N. Y.
 119-120-235-236—Linscott Motor Co., Boston.
 515-516—Linscott Supply Co., Boston.
 237—Lippard-Stewart Motor Car Co., Buffalo, N. Y.
 13 and 17-245-246—Locomobile Co. of America, Boston.

M.

15 and 19—MacAlman, J. H., Boston.
 243-244—Mack Motor Truck Co., 185 Massachusetts Ave., Cambridge, Mass.
 329b-330—Maddocks Co., H. Ross, Boston.
 307—Magnus, M. E., New York City.
 16 and 20-248-253 Inc.—Maguire Co., J. W., Boston.
 423b—Malton Specialty Co., Inc., Boston.



Layout of Display Spaces in Basement Where Commercial Cars Will Be Shown.

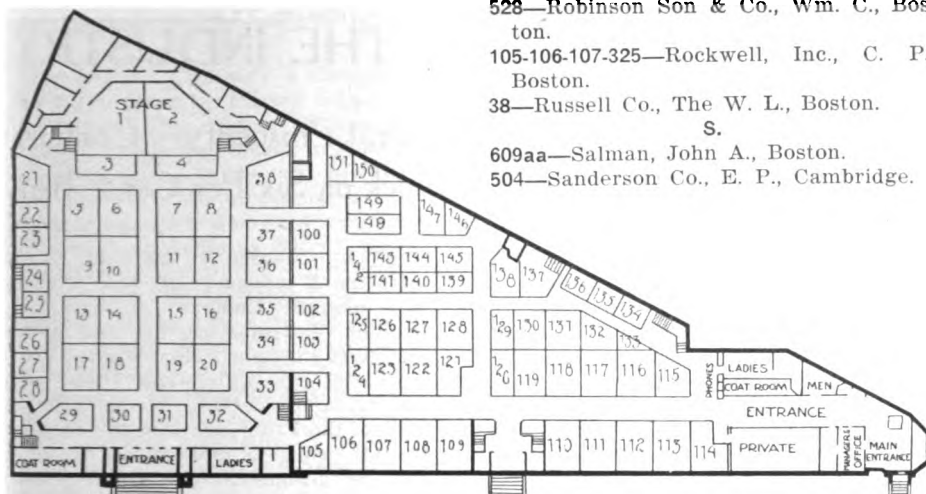


Diagram of Floor and Reservation Arrangement of Main Floor of Mechanics' Building.

615—Militaire Motor Vehicle Co. of America, Inc., Buffalo, N. Y.

N.

510—National Auto Assn., N. E. Department, Boston.

26-27-28—National Car, Boston.

412—National Oil Co., Boston.

547—National Sportsman, Inc., Boston.

210-211—Netco Trucks, Fitchburg, Mass.

533—Newton, J. Edward, Fall River, Mass.

555—Newton, Richard T., New York City.

210-211—New England Truck Co., Fitchburg, Mass.

440—New York Lubricating Oil Co., Boston.

616—Northern Sales Co., Inc., 113 State St., Boston.

226—Noyes-Buick Co., The, Boston.

O.

148-149—Oakland Motor Co. of N. E., Boston.

4—Oldsmobile Co. of N. E., Boston.

129-130-131—Overland Cars, Boston.

3—Owen Magnetic Cars, Boston.

P.

1 and 203-208 inc.—Packard Motor Car Co. of Boston, Boston.

24-25—Paige Motor Co. of Boston, Boston.

14 and 18—Peerless Cars, Boston.

150-151—Pathfinder Cars, Boston.

531—Pettingell-Andrews Co., Boston.

16 and 20—Pierce Arrow Cars, Boston.

407—Planet Company, The, Westfield, Mass.

518-519—Platt & Washburn Refining Co., Boston.

Paul Revere Hall—Pope Hartford Co. of Boston, Boston.

150-151—Porter Motor Sales Co., Boston.

212-213—Premier Cars, Boston.

449—Pressure Proof Piston Ring Co., Boston.

402—Prismatic Lens Co. of N. E., Shelburne Falls, Mass.

622—Pruden Co., The C. D., 39 Columbus Ave., Boston.

421-422—Pullman Motor Car Co., York, Penn.

R.

552—Rand, H. L., Worcester, Mass.

119-120-235-236—Reo Cars and Trucks, Boston.

150-151—Regal Cars, Boston.

623—Reliance A. C. Co., Inc., 2 Rector St., New York.

102-103—Renault Cars, Boston.

528—Robinson Son & Co., Wm. C., Boston.

105-106-107-325—Rockwell, Inc., C. P., Boston.

38—Russell Co., The W. L., Boston. S.

609aa—Salman, John A., Boston.

504—Sanderson Co., E. P., Cambridge.

335 and 346-351 inc.—Studebaker Corp. of America, Boston.

123-124—Studebaker Cars, Boston.

T.

219-220-221—Taylor Corporation, R. E., Boston.

419—Texas Company, The, Boston.

301—Tompson, N. W., 911 Boylston St., Boston.

309—Tiffany Co., D. C., Boston.

227-28—Touraine Co., The, Philadelphia, Penn.

216—Transport Tractor Co., Inc., Long Island City, N. Y.

353—Trumbull Cars, Boston.

356-357—Turner Ring Co., Boston.

563—Travers Co., Jas. A., Boston.

605—Twin Rim Co., Boston.

U.

534-535—Underhay Oil Co., Boston.

209—United Motor Truck Co., Grand Rapids, Mich.

439—United States Rubber Co. of N. E., Boston.

559—U-Sav-Your Mfg. Co., Warren, Mass.

617—Utility Products Co., 814 Times Bldg., New York.

V.

518-519—Veedol Motor Oils, Boston.

5 and 9—Vellie Cars, Boston.

318 and 322—Victor Motor Car Co., Boston.

227-228—Vim Truck Co., Boston.

W.

240-241—Waite Co., H. S., Boston.

562—Waldt, Ralph, New York City.

309—Ward Electric Trucks, Boston.

553—Webber Mfg. Co., Boston.

115-116 and 133—Wentworth-Fosdick Co., Boston.

326-327—Wentworth-Fosdick Co., Boston.

214—West Steel Casting Co., The, Cleveland, O.

433—Westinghouse Air Spring Co., Boston.

212-213—Westcott Cars, Boston.

560-561—Wetmore-Savage Co., Boston.

7 and 11-254-255-256—White Co., The, Boston.

229-234 inc.—White Co., The, Boston.

129-130-131—Willys-Knight Car, 167 Massachusetts Ave., Boston.

409-410—Wilson Co., John V., Boston.

8 and 12—Wing, Frank E., Boston.

6 and 10—Winton Co., The, Boston.

529—Wonder Mist Co., The, Boston.

404—Wright, John M., 27 Sherwin St., Waterville, Me.

Y.

224—Young Co., E. C., Randolph, Mass.

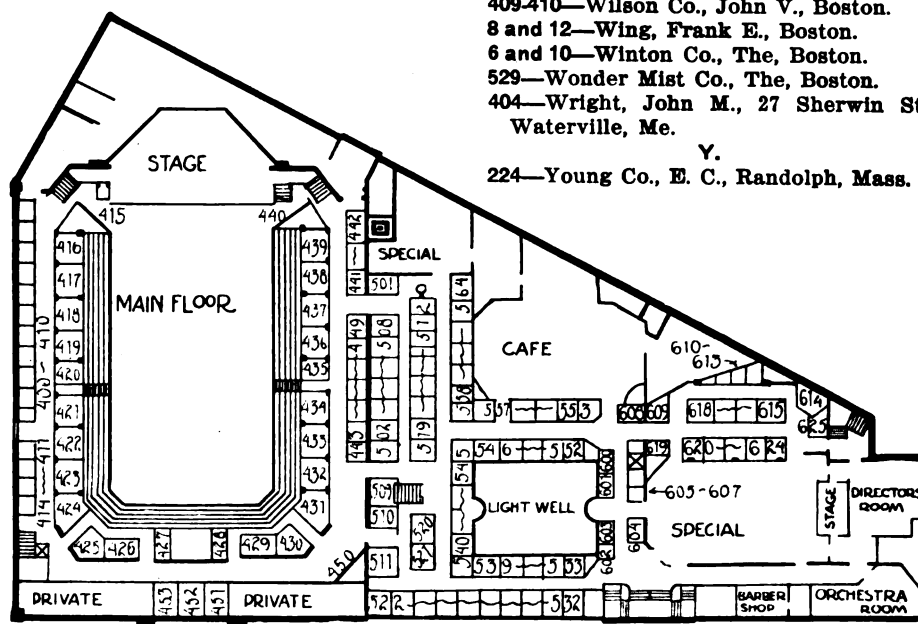


Diagram Plan of the Balcony Floor and Exhibition Booths.

FINANCIAL AND GENERAL NEWS OF THE INDUSTRY.

Semi-Annual Report of the General Motors Company Indicates Great Prosperity—Continental Motor Declares Surprising Dividend and Chandler Places Its Stock on Six Per Cent. Basis

Reports of the General Motors Company for the six months ending Jan. 31, 1916, show that during that period the company did twice the volume of business done during the corresponding six months of the previous year.

Cars and trucks	1916	1915	Increase
sold ..	62,468	31,608	30,860
Gross sales...	\$74,000,000	\$36,857,394	\$37,142,606
Und'v'd profits	13,000,000	6,446,534	6,553,466

After deducting \$524,482 for preferred dividends the balance of undivided profits for the six months was \$12,475,518, which is equal to 75 per cent. on \$16,506,783 common stock, or at the annual rate of 151 per cent., as compared with 81.2 per cent. for the year ended July 31, 1915.

President Nash issued a statement, however, that while this unusual business had been done during the past six months and the demand for automobiles had never been as great as it is now, conditions exist which may make the next six months less profitable.

"The situation in the materials market," he said, "is very unusual and I believe that we shall experience difficulty in getting sufficient materials to operate our plants to their capacities. There is also a shortage of freight cars to move the product and it is not likely that this condition will improve for some time."

CONTINENTAL'S SURPRISE.

What is described as the surprise of the year was the declaration by the Continental Motor Manufacturing Company, Detroit, of a 100 per cent. stock dividend. The dividend will amount to \$2,900,000, increasing the capital stock to \$5,900,000, with \$1,000,000 of the common stock still in the treasury.

The Continental company made a profit of \$1,500,000 last year on a capital of less than \$1,000,000.

FISK'S HUGE SALES.

At the annual meeting of the Fisk Rubber Company, held at Chicopee Falls, Mass., it was announced that sales for the fiscal year amounted to \$14,500,000, and net profits to \$1,791,579.

The matter of authorizing additional capital stock was not taken up, and the meeting was adjourned to March 8 for action on the question. The regular quarterly dividends of 1½ per cent. on preferred, payable May 1, and on second preferred, payable June 15, were declared. The officers and directors were re-elected.

CHANDLER'S FIRST DIVIDEND.

The Chandler Motor Company, which was reorganized last fall, has placed its stock on a basis of six per cent. per annum by declaring a quarterly dividend of six per cent. upon the common. The price has risen lately on the outside market to \$94. There is \$7,000,000 outstanding in stock. There are no bonds and the company has no debt.

On Feb. 4 the company's cash balance amounted to \$1,593,675, which is equivalent to \$22 a share, and the big selling season is still to come. The present output is 60 cars daily and the schedule calls for a steadily increasing production. During the current year it is expected the company will sell between 15,000 and 20,000 cars. Large quantities of materials were contracted for last year and no interruption of production is being experienced.

The company is earning at the rate of \$25 a share and the six per cent. dividend is regarded as very conservative. At the present rate earnings enough for the dividends for a year, amounting to \$420,000, will be secured by April 1.

SAXON BUSINESS BIGGER.

During January the Saxon Motor Car Company received orders for 6792 cars for immediate shipment. These orders were more than double the number of those for the best previous month, which was May of last year, when 3318 were purchased. The record is more remarkable in view of the fact that in past years January has been a dull winter month, while May is in the heart of the spring selling season.

Orders taken at the Chicago show totaled 3400, while 2000 were gathered at New York. Orders for a train load of Saxon cars at one shipment have been received from Los Angeles, San Francisco, Spokane, Dallas and Muskegon. Two train loads were ordered for New England, and large orders were accepted from Des Moines, Syracuse, Minneapolis and other points.

NEW CORPORATION.

Louis Chevrolet and a group of eastern automobile men have formed the American Motors Corporation, which is to engage in the manufacture of motor cars on a large scale. The company is capitalized at \$1,250,000. It will put out a moderate priced car.

The group includes William Howard Hoople of the Interstate Electric Corporation, John C. Speirs, formerly general manager of the Autocar company and factory manager for Locomobile, Mercer, S. G. V. and the Standard Roller Bearing

Company; George F. Baright, formerly advertising manager of the Prudential Life Insurance Company of Newark, N. J.

Louis Chevrolet will be vice president and chief engineer. He designed the first Chevrolet car, which has since become a very large success. He is also president of the Frontenac Motor Company of Detroit, which is developing racing cars that he designed. The main plants of the new company will be located in the East in order to be near that large market.

STATES M. C. REORGANIZED.

The States Motor Car Company has been organized in Kalamazoo, Mich., with a capital of \$600,000 and will immediately begin the production of four and eight-cylinder pleasure cars and a light commercial wagon. The officers are John Pyl, Kalamazoo, president; James H. Johnson, South Haven, vice president; B. R. Barber, Kalamazoo, vice president; Samuel Hokestra, Kalamazoo, secretary-treasurer. The directorate includes the officers, except Hokestra, and George B. Pulfer, Kalamazoo; W. B. Smith, Toledo; Ira Cadwallader, Fostoria; James H. Johnson, South Haven.

The company has purchased the plant of the defunct Michigan Buggy Company, which has a total floor space of 340,000 square feet. The first cars will be delivered about April 15. The product will be handled by the States Motor Car Company, a selling organization with 40 zone managers and a combined capital of \$1,700,000.

The main offices will be located at Kalamazoo and the general sales manager will be W. B. Smith. Zone managers have been secured for Michigan, Ohio, Indiana, Iowa, Minnesota, northern Illinois, southern Illinois, Wisconsin and Missouri. The car will have a 115-inch wheelbase and the weight will be 2200 pounds. Everett J. Cook is the designer.

FORD TO PAY WAR TAX.

If the war budget before the Canadian parliament is passed the Ford Motor Company of Canada will be obliged to pay about \$2,000,000 for British war taxes. The budget calls for payment of one-fourth of all profits above seven per cent for the period from August, 1914, to August, 1917. Officials of the Ford company declared that they had no criticism to offer and would willingly pay. It would make little difference to their stockholders' dividends they declared, as a large proportion of the company's earnings were being set aside for plant enlargement.

NEW BARRETT COMPANY.

The Barrett Company is the name of a new corporation which will take over the business of the Barrett Manufacturing Company and the American Coal Products Company. In the past the stock of the Barrett Manufacturing Company, which made such well known and widely advertised products as Barrett Specification Roofs, Tarvia and Congoleum, has been held by the American Coal Products Company. The two were not associated in the public mind and, therefore, the parent concern did not benefit in the strength of its securities from the wide advertising and reputation of the Barrett Manufacturing Company.

The new company will have the same amount of stock as the American Coal Products company and the change will be made by exchanging share for share. The products of the chemical department of the Barrett Company are being developed rapidly at this time and owing to the European situation it is expected that this branch of the business will grow fast in the near future.

CHEVROLET PRODUCTION.

It is reported in financial circles that the Chevrolet Motor Company has been so successful in expanding its production that the output for 1916 will be as great as was anticipated for the end of 1917, when the company was publicly financed last year. Unless unexpected difficulties in securing material or freight cars are encountered, Chevrolet will produce 75,000 machines in the 12 months ending Sept. 1. This is a jump from 10,000 cars in 1914.

The schedule calls for 22,000 cars in July and August and 51,000 cars will be shipped during the last six months of the year. The daily schedule for August calls for 460 cars, while last September the production was less than 100. If these figures are realized the profits for the year will be about \$6,000,000 on a capitalization of \$20,000,000.

PEERLESS BONDS OFFERED.

Hodenpyl, Hardy & Co. of New York City have formed a syndicate to sell \$2,000,000 worth of Peerless Truck and Motor bonds. They run 10 years, are convertible at par into common stock, and pay six per cent. The notes are part of an issue of \$5,000,000 of which the balance is said to have been taken by those identified with the corporation. For the 11 months ended Nov. 30, 1915, Peerless Truck and Motor earned \$1,930,058, or at the rate of \$9.65 a share.

HIPPLE JOINS MITCHELL.

Otis C. Friend, general sales manager of the Mitchell-Lewis Motor Company, announces that George W. Hipple, recently vice president and general manager of the Carl H. Page Motors Company, with headquarters in New York City, has been secured by the Mitchell

company to act as general merchandising counsel.

Together with Carl H. Page, Hipple organized a sales company that in six months sold a million dollars worth of Mitchell cars in New York. He is well acquainted with the Mitchell product and is expected to obtain great results in the national field. Before entering the automobile business 10 years ago he was connected with the merchandising departments of the National Cash Register Company.

COBURN MAXWELL ADVERTISER.

Andrew E. Coburn, formerly advertising manager of the Cleveland Twist Drill Company, has been appointed advertising manager of the Maxwell Motor Car Company. He will have full charge of the preparation of display copy and the selection of mediums. He has had long advertising, sales and agency experience.



Andrew E. Coburn, Advertising Manager, Maxwell Motor Car Company.

The present Maxwell campaign running throughout the country was prepared by him.

GODDARD JOINS DODGE BROTHERS.

George E. Goddard has resigned his position as engineer of the body division of the Packard Motor Car Company to become assistant chief engineer of Dodge Brothers. Edward H. Belden has been appointed to succeed Mr. Goddard. He has been associated with J. G. Vincent, vice president of engineering, for some time as a research engineer. He was educated as an electrical engineer and has invented numerous improvements on arc lamps. The Belden arc lamp is his invention. A few years ago he invented a gearless transmission for motor cars.

HOLTON LEAVES FARMACK.

Hoover Holton has resigned as general sales manager of the Farmack Motor Car Corporation. The resignation goes into effect March 1. His new connection has not yet been announced.

GUNN PREMIER ENGINEER.

Announcement is made that E. G. Gunn, chief engineer of the Northway Motor Company, Detroit, for the past five years, has been engaged as head of the engineering corps of the \$2,500,000 Premier Motor Corporation of Indianapolis. He will be assisted by Charles S. Crawford, chief engineer at the Cole factory for the last seven years, and for two years of that time factory manager also. Gunn and Crawford are well acquainted professionally because the Cole company has always used Northway motors. J. L. Yarian, designer of the original V type Glenn Curtis aeroplane motor, and the designer of one of the 12-cylinder overhead valve motors that is now in successful use in this country, is another member of the department. He also is responsible for the Yale motorcycle motor, which holds the world's record for speed and endurance. He will work for the present on the racing motor that the Premier corporation is to build.

Gunn is a graduate of the University of Michigan. Before going with the Northway company he was in the engineering department of the Buick company. Crawford is a graduate of Washington university. Before joining Cole he was in the engineering department of the Lozier company and has had wide production experience.

Frank E. Smith, one of the Premier directors, declares that Gunn is known as one of the most able engineers in the country specializing in motors, while Crawford's specialty is chassis design. The combination has had experience in working together.

RANKIN HEADS MAHIN COMPANY.

John Lee Mahin, founder of the Mahin Advertising Company, has disposed of his interests to William H. Rankin, who becomes president. Mr. Rankin has been vice president for seven years. He arrived in Chicago in 1907 to assume the management of the street railways advertising company under Thomas Balmer, who is now in England. Before that he had been circulation manager of the Star League newspapers, advertising manager of a farm paper and business manager of the Bobbs-Merrill magazines.

Wilbur D. Nesbit will be vice president of the company and Herman A. Groth will continue as secretary and treasurer. The organization will remain intact.

In commenting on the arrangement, Mr. Mahin said that inasmuch as he had picked the men for the work they are now doing, patrons could not suffer by the change. He will work out a long cherished plan of living and doing business in New York City, where he will open an office on May 2.

HOMAN PROMOTED.

The board of directors of the H. A. Lozier Company, Cleveland, makers of the "H. A. L. Twelve," recently made C. C. Homan vice president. He will have charge of the company's purchasing and will also be an important factor in the company's production department.

LEWIS R. SPEARE IS DEAD.

Lewis R. Speare, former president of the A. A. A., the first president of the Bay State Automobile Association, and



Lewis R. Speare, Prominent Massachusetts Citizen Recently Deceased.

one of the chief organizers of Massachusetts State Automobile Association, died at his home in Newton, Mass., on Feb. 23 after a lingering illness of several weeks.

Mr. Speare was born in Boston on June 6, 1861, and was one of the first men in the country to take up motoring, and was known throughout the country for his indefatigable efforts in legislative matters affecting motorists. He was a widely known financier and executive, being connected with some of the largest enterprises in various parts of the country.

CLINE JOINS SUN.

R. Crawford, president of the Sun Motor Car Company, Elkhart, Ind., announces that B. J. Cline, one of the oldest production men in the industry, will join the Sun organization as factory manager. Mr. Cline assisted in building the first Pierce-Arrow car and was later connected with the E. R. Thomas Company of Buffalo and the Chalmers Motor Car Company of Detroit, which he left to join the then new Chandler Motor Company. He guided the production of that company from nothing to 20,000 cars a year and oversaw the erection of its five buildings with 150,000 feet of floor space. He will assume his new duties March 1.

The Sun company is already beginning production and will turn out 90 cars during March.

WELLMAN IS OLDS ADVERTISER.

Jay V. Hall, general sales manager of the Olds Motor Works, announces the appointment of Fred Wellman as advertising manager of the company. Wellman was formerly confidential assistant and advertising counsel to Carl G. Fisher in the Indianapolis speedway and other enterprises and is well known in the automobile business. C. V. McGuire, former advertising manager of the Olds company, has joined the Cheltenham Adver-

tising agency in New York City, where he will handle a number of automobile accounts.

A NEW OVERLAND RECORD.

The Willys-Overland Company, Toledo, recently established a new record for February production. The company reports that during that month in 1915 there were 5627 Overland cars shipped, while this year more than that number of cars were produced during the first two weeks.

BUICK ADVANCES PRICES.

The Buick Motor Company, Flint, Mich., has announced an advance of \$35 in the price of its light sixes, the new prices being \$985 for the roadster and \$1020 for the touring car. They will carry 34 by four-inch wheels and tires, instead of the former 32 by four-inch. These prices and models will be maintained through the entire 1916 season.

BIMEL CHANGES NAME

The Bimel Buggy Company, Sidney, O., has been reincorporated as the Bimel Automobile Company and its capital has been increased to \$500,000. The buggy company was begun 72 years ago, the present organization taking charge of the plant in 1905.

In the future the company will concentrate on four and six-cylinder automobiles, giving up the vehicle end of the business. The four-cylinder model has been selling for \$585, while the six-cylinder car, a recent production, is priced at around \$1000. The latter will be ready for delivery about April 1.

BRISCOE EXPANDING.

The Briscoe Motor Company, Jackson, Mich., has closed a deal whereby it will take over the Jackson Motor Shaft Company as a part of the Briscoe organization. The change will be made July 1.

The Jackson Shaft Company has about 180 men on its payroll, and is the successor of the Hastings Motor Shaft Company. The general manager, L. C. Bloomfield, will be retained.

SHORTENS NAME.

The Continental Motor and Manufacturing Company will be known hereafter as the Continental Motor Company, the change having been made at the recent stockholders' meeting.

PENN. S. A. E. ORGANIZES.

The organization meeting of the Pennsylvania S. A. E. was held Wednesday evening, Feb. 16, 1916, at the Engineers' Club of Philadelphia, 1317 Spruce street. The leading feature of the evening was a paper by A. M. Dean on "An American V Type Motor Development."

FORD LOSES TAXI FIGHT.

A regulation of the New York license commissioner requiring that taxi cabs of a certain size carry only a single taximeter and charge fare for only one or two passengers has been upheld in the courts after an attack by the Ford Motor Company. The regulations require that taxicabs carrying double taximeters have seats 48 inches wide and 29 inches of knee room. Ford cars have only 46-inch seats and 26-inch clearance for knees. The rates permitted the cabs of the first class are 70 cents for the first mile and 60 cents for each succeeding mile, while the small cabs can charge only 50 cents for the first and 40 for each additional. The new regulation went into effect Feb. 1. Before that the Ford company had protested to city officials and it then took its fight to the courts.

BARTZ WITH STAYBESTOS.

The Staybestos Manufacturing Company of Germantown, Philadelphia, Penn., has reorganized its sales department with the appointment of Mr. J. H. Bartz as sales manager and Edward W. Barry as advertising manager.

Frank H. Pietsch, who has been identified with the motor vehicle industry practically since the first gasoline truck was put on the market, has been appointed manager of the Packard Motor Car Company's truck department.

JOHNSON RE-ELECTED.

R. H. Johnson, manager of the New York branch of the White Company, was unanimously re-elected president of the Automobile Dealers' Association of New York. William C. Poertner of the Poertner Motor Car Company, was elected to the vice presidency, and Charles M.



R. H. Johnson, Re-Elected to Presidency of Automobile Dealers' Association of New York.

Brown was chosen secretary and treasurer.

This is the third term for Mr. Johnson as president of the association.

HARTFORD SHOW MOST SUCCESSFUL YET.

HARTFORD, CONN., held its 1916 automobile show in the Broad street armory. The space available was divided into 98 sections and there were 74 exhibitors, presenting a very complete line of motor cars. Here, as at every other show that has been held this year, there were evidences that this will be the greatest season the industry has known.

More attention had been paid by the distributors to decorations and display than at any other show they have held. Most of them had visited New York for the purpose of picking up decorative ideas and these had been worked out with great care.

Hartford, as a distributing point, has been increasing rapidly in importance and the makers this year acknowledged their appreciation of this fact by sending factory sales representatives to help the local dealers with their show sales.

The attendance was larger than previously and the volume of business done extremely satisfactory to the local dealers. Credit for the successful show is largely due to Bernard F. Smith, who managed it, and to Russel P. Taber and John D. Evans, members of the show committee.

Practically all of the well known American cars were present and the display was very representative. It covered every type of car. The prices ranged from \$395 to \$6500.

PORTLAND SHOW STATE'S LARGEST.

The greatest automobile show that has been held in the State of Maine opened in Portland, Me., in the exposition building, Feb. 21, to continue for a week. The show was under the immediate direction of the Portland Automobile Dealers' Association, but dealers from all over the state, most of whom do business through Portland distributors, were interested in it.

There were nearly 100 exhibits, making up a very complete and representative line of the motor products that are this year offered to American buyers. Very cold weather adversely influenced attendance during the early part of the week, but there was a fair crowd and sales started off promptly, the Inter-State representatives making the first sale.

Both the main floor and the basement of the building were completely occupied by exhibits. Manufacturers recognized fully the importance of the show by supplying the most desirable displays available and by having on the ground factory representatives to explain mechanical details and principles.

The lobby was decorated with potted ferns, and dainty white stands trimmed with gold supported baskets of flowers. In the centre of the main floor was a pagoda for the Boston Ladies' orchestra, which gave an elaborate programme of music for the week. This was cream colored and generously decorated with flowers on all sides.

The various exhibition spaces were

roped off with green cord. Over the entrance to each was an arch of flowers. From the main doors a long aisle of flowers led down the main floor and diverging in the centre to either side of the band stand. Flags and bunting had a large part in the decorations.

The management of the show was in the hands of the officers of the dealers association, William B. Thombs, president; Luther C. Gilson, vice president; Ernest E. Brewer, treasurer, and Howard B. Chandler, clerk.

BALL DISCUSSES OUTPUTS.

F. C. Ball, president of the Inter-State Motor Company, Muncie, Ind., and head of Ball Brothers, the glass firm that is a large producer of glass fruit jars, thinks it possible that the year's production of motor cars may reach the total of 1,200,-



F. C. Ball, President of Inter-State Motor Company.

000 set by the estimate of the Automobile Chamber of Commerce. This is 50 per cent. of the number of cars now in use and those that were made in the 10 years from 1903 to 1913.

The constantly widening market is due to the fact that the cars are becoming better and cheaper in price as the country becomes richer. In addition, the foreign markets are taking constantly more cars.

At present the pressing problem for makers is to get materials with which to fill the orders that they already have. The next problem is that of quality. Cars that have been lowered in price by cheapening the quality, Mr. Ball believes, will soon feel the evil effects of such a policy.

FAVORS MAGNETO IGNITION.

William J. Hart, a well known electrical engineer, has declared himself in favor of magneto as compared to battery timer ignitions. The following is a digest of his remarks:

The magneto has the great advantage

of giving an increasingly hot spark as the engine speed increases and such a hot spark removes the carbon from fouled plugs or prevents clean ones from becoming foul. Magnetos are also capable of maintaining perfect ignition at the lowest possible engine speeds.

Storage battery ignition was abandoned in favor of the magneto immediately the latter was developed to its present perfection because of the voltage and current volume increase and decrease with the speed of the engine. This makes it unnecessary to move the spark control lever constantly to adapt the spark to the speed of the car. Much manipulation of the battery ignition advance lever is necessary if one is to get good power from the engine.

Battery ignition systems cost less than magneto systems for the reason that the battery is a necessary part of the modern car to operate the starter and lights. But it does not give the best spark for starting because when the starter is operated there is an abnormal flow of current and the battery charge is often reduced as much as 25 per cent. Coils to operate successfully must be wound for the voltages at which they are expected to work and this variation in the battery makes impossible a fat spark for starting purposes.

The storage battery in the hands of the novice is seldom kept in good condition, and as that is the most important link in the electrical system, it often brings about bad results. Mr. Hart believes that the carbonizing of the engine and deterioration of the exhaust valves is due to faulty ignition more than to bad gasoline or oil.

He says that on some battery and distributor equipped cars switches have been mounted on which the starting point is marked "Bat," while the running notch is marked "Mag," in spite of the fact that there is no magneto on the car. He condemns this as an unjustifiable way of fooling the public even with the intent to prove to them that the battery system is "just as good."

ECONOMIC VALUE OF GOOD ROADS.

Great gains for the farmer are seen by John N. Willys in the development of good roads. On the other hand, he predicts great losses for the small town merchant unless he is diligent in seeing that the roads leading into his town are improved.

The amount of money spent on road improvement in the United States last year, according to Mr. Willys, was \$250,000,000, which is just the amount that the Department of Agriculture estimates that the farmers of the country are losing every year as a result of their inability to get their products to market at certain seasons because of bad roads.

The good roads already built have caused an increase of from 100 to 400 per cent. in the values of the lands adjoining. If an equal amount of money is put into

good road improvement during the next 10 years, the United States will have 500,000 miles of the finest highway in the world at a cost of approximately \$2,500,000.

Mr. Willys believes that the automobile has been the chief cause of directing the attention of the people to good roads work and that with the great increase in the number of cars that is sure to come much more will be accomplished.

He further believes that the town or village that neglects its streets or roads will lose heavily, because it will be avoided by motor car owners, who will patronize other towns further away that can be approached by good roads. Competition between cities and towns will force them to keep up with the procession in the matter of road building.

Newspapers and magazines are doing a great work for good roads and he especially approves the printing of maps and routes which point out where the improved roads are, so that motorists will be able to avoid localities where the roads are poor.

CONCORD SHOW IS SUCCESSFUL.

The fourth annual show of the Concord, N. H., dealers was opened in the auditorium in that city on Feb. 21. Rough weather during the early days of the week kept the attendance down somewhat, but the city had demonstrated fully that it was interested in the new motor cars and in buying mood.

The show was under the direction of Carl W. Blaisdell, who was responsible for all its details. The exhibits quite filled the small space in the auditorium, although it was not so full but what ample opportunity to examine all the cars was provided.

Many out of town visitors, both dealers and prospects, came to Concord during the week to examine the exhibits.

COLE BUSINESS LARGE.

Improved business conditions over a year ago make themselves evident to the Cole Motor Car Company by an increase of 100 per cent. in the orders taken during the automobile shows. Although buying is more active, competition is keener. C. P. Henderson, general sales manager of the Cole company, credits the increase in their business to the improvement in the car offered this year for \$200 less than last year.

HIGH PRICED CARS.

In spite of the immense increase in the number of sales of low and medium priced cars, one of the most interesting facts concerning the present situation in the industry, in the view of Andrew L. Riker, vice president and chief engineer of the Locomobile Company of America, is the continued demand for high priced cars of the most luxurious type.

It is now certain that there will be a shortage of high priced cars for months to come. With the exception of two or

three of the old time makers of this type of machine, most of the producers have changed their policy and directed their efforts toward the medium priced trade.

The result, in Mr. Riker's opinion, is that production of this kind of motor vehicle has been reduced far below the demand. At the same time the prosperity of the country has placed a very large number of people who were not previously in the high grade market in a position where they may demand a luxurious car if they desire.

One of the companies that has never lowered its prices or compromised with its quality is the Locomobile Company of America. It may even increase the price because of the increasing cost of material and labor. Yet it is doing a splendid business and finds itself unable to turn out cars as rapidly as they are desired.



Andrew L. Riker, Chief Engineer of Locomobile Company of America.

The amount of production is very limited and will be consistently kept so.

GIVES HORSE AMBULANCE.

A motor horse ambulance, consisting of a short one-ton Garford truck chassis with a two-wheeled trailer behind, has been presented to the Massachusetts Society for the Prevention of Cruelty to Animals by Mrs. David Nevins of Methuen, Mass.

The ambulance was built by the Monahan Vehicle Company, Providence, R. I. The chassis has a very short wheelbase to provide good traction. The rear tires are solid, while those in front are pneumatic. The vehicle is a two-wheeled trailer with a snynbill connection, which gives universal motion between the tractor and trailer.

The floor of the trailer is inclined toward the rear, so that the tail end is close to the ground to facilitate loading. The end gate, when down, forms a skid on which the animal can enter. If he is lying down a rolling platform is used.

The animal is placed on the platform and his head securely fastened and has a pillow under it. The platform is drawn

into the body by a wire cable, which is operated by a worm and gear winch placed in front.

Side and top curtains are furnished for protection from bad weather. Lamps are supplied so that animals can be loaded after dark.

PUBLIC SCHOOL SIGNS.

In Cleveland, O., it has been the practice to post a policeman on street crossings near schoolhouses at the hours when children were passing. There are not, however, enough policemen to cover all the points that need to be protected and to make up the deficiency the Cleveland Automobile club is placing conspicuous signs marked "Public School, Drive Slow," near school buildings, and is urging all of its members to take great care in observing the injunction.

TEACH ROAD BUILDING.

Eighty-three universities and colleges are now giving courses connected with the building of roads. It has been recognized that no instruction in civil engineering is complete which fails to cover the subject.

Many of the large institutions have opened regular courses in highway engineering, while others are giving short courses of a week each month or two in the winter when practical road builders are not employed and can attend.

A good roads school is being held at Purdue university, Indiana, and the University of North Carolina. Cornell will devote a week in February to the subject. The University of Tennessee has provided a short course in highway engineering, the University of Illinois has established a similar course, and also the University of Michigan.

The University of West Virginia has just completed the third annual session of its school for good roads. A post graduate course is offered in Ohio State college. A special course for county road officials will be given at Kentucky State university in Lexington. Columbia has made a regular feature of the work, which has also been introduced at the Maryland Agricultural college.

NATIVES LIKED CARS.

About a year ago a speculator in La Ceiba a town of 7000 population in Honduras, invested in a motor car to be used as a taxi cab. There are roads from the town only about a mile in each direction and on the other side is the Gulf of Mexico.

So interested were the natives that for weeks he got more passengers than he could carry at \$1 in gold for a 20-minute ride. His receipts averaged \$100 a day. This was too good to last and he soon had competition. There are now 10 cars that are used as public vehicles and they have practically driven the horse cabs off the street already.

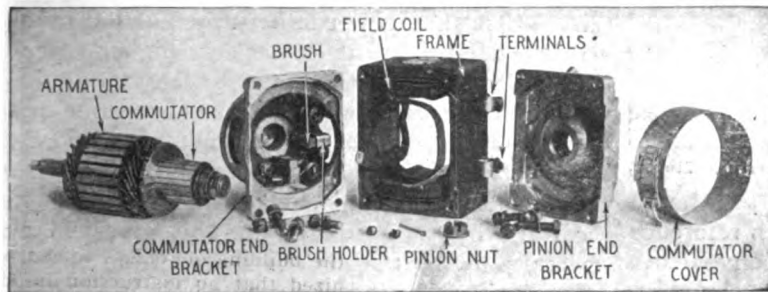
There is no repair shop in town and no one qualified to do repair work.

MOTOR STARTING AND CAR LIGHTING.

Different Forms of Coupling Westinghouse Flywheel Equipment—The Mechanical, the Automatic and the Electro-Magnetic Types of Shifting the Engaging Pinion.

COUPLING the electric motor and the engine is an engineering proposition that has been given much attention by manufacturers of engine-starting equipment. The engine can only be started with leverage applied to the crankshaft,

The possibilities of development are by no means known. While there is a desire to minimize weight, there is also emphasized knowledge that machines must be made sufficiently heavy to endure when operated by those who are ignorant and indifferent, and who subject them to abuses that would seldom be conceived by those who are expert or even familiar with electric apparatus. No matter what care is taken to insure reliability and efficiency, neither of these can be obtained if batteries are neglected, if the motors are heavily overloaded, if the general rules for operation are ignored.



A No. 300 Starting Motor Disassembled, Showing Different Components.

or through the crankshaft, and this is the logical point to apply power, because the shaft is designed to endure strains and stresses and it cannot be affected by starting with extremely adverse conditions. So far as is known, no engine has been designed and developed to conserve battery current in starting. In fact, there is doubt that this quality has ever been seriously considered in engine designing.

There can be no question, however, that eventually attention will be directed toward obtaining greater and higher efficiency from electric batteries used in pleasure cars for lighting, lighting and engine starting, or lighting, engine starting and ignition. There are innumerable reasons for this statement. The battery may be from six to 24 volts and from 35 to 120 ampere-hours capacity. The number of cells is proportionate to the voltage, and as a six-volt battery would require but three cells, against six cells for 12 volts and so on, evidently the smaller number of cells with greater amperage capacity would weigh less than six or more cells with less amperage, for the amperage in any event is dependent upon the size of the cell and not the number.

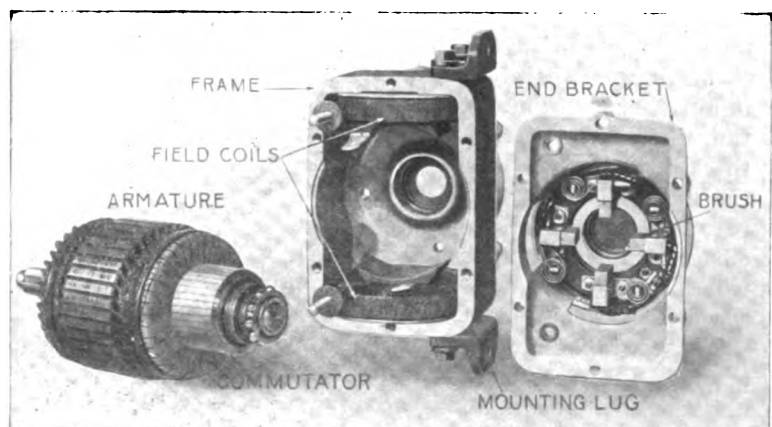
Weight an Important Factor.

Weight is regarded as very important in equipment of a pleasure car and every endeavor has been made to keep the units to minimum size that there shall be no superfluous load, for fuel must be consumed to drive the machine, and fuel economy is a very important factor to those who own and drive automobile vehicles.

Westinghouse equipment is today used by the manufacturers of more than 50 makes of cars and trucks, and generally speaking the latest products are all the two-unit systems, the generators being driven by the outside shafts from the timing gearset, and the motors as a rule coupled to the flywheel.

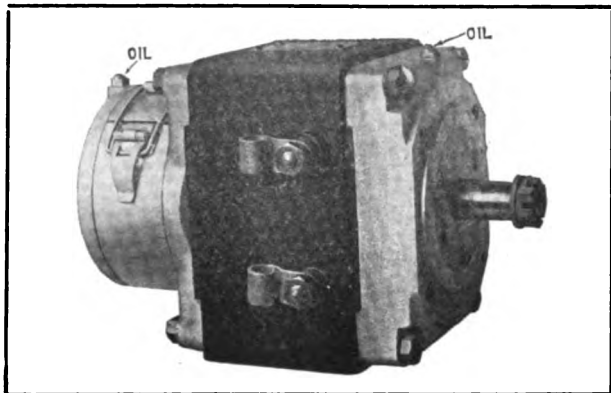
The machines are so designed that the generators may be securely seated on frames or bases on the engine cases, so that they may be driven by shafts having couplings that will be efficient even should there be a change in alignment, this obviating the need of chains, over-running clutches or multiple gearing. One of the difficulties experienced has been the neglect of the owners and drivers, who do not keep the means of drive in adjustment, which may result in noise and unnecessarily, this being a reason for dissatisfaction, and this, more than any other reason, has impelled the shaft drive as being more satisfactory.

The logical location of the starting motor for



A Rectangular Frame Type of Motor for Flywheel Drive with End Plate and Armature Removed.

flywheel coupling is at the rear end of the cylinder block, but it may be at either side and above or below the line of the horizontal diameter of the flywheel. Of course much depends upon the design of the engine case. If the case is specially



The Westinghouse Rectangular Frame Starting Motor, No. 300.

designed the motor may be placed with reference to other considerations. Ordinarily, convenience would suggest that the motor be above the chassis frame, so it could be reached by lifting the hood for examination of the brushes and commutator, or for lubrication, and where it would be removed so far as possible from the accumulation of dust or from water, and where the case may be easily cleaned. If below the frame it ought to be so placed that it need not be removed in the event of the removal of the lower section of the crank case.

Engines Designed for Equipment.

Engine builders who design their engines for the installation of starting motors, either cut teeth in the periphery of the flywheel, with sufficient clearance for the armature shaft pinion between the flywheel and the housing, if a unit power plant, or increase the size of the flywheel housing and shrink or bolt a ring gear onto the flywheel with which the armature shaft pinion may mesh. There is need of great care in the adaptation of an engine for a starting motor, for the flywheel gear ought to be so proportioned that it will endure the very severe strain under the small steel pinion when the motor is turning the engine, and if an external ring gear this ought to be of such metal and so cut that it will not unduly wear. The greatest protection that can be given is in the size of the flywheel gear teeth, for usually the flywheel is cast iron and is comparatively soft unless specially treated to obtain endurance and to resist wear.

Power Required of a Motor.

Those who believe that a small motor does not exert great power should understand that in starting an engine the strain upon the armature pinion and the flywheel gear is very sudden

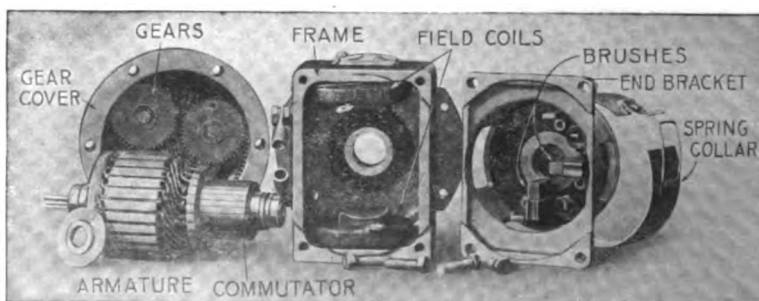
and severe, despite the means of regulating the application of the energy. The Westinghouse motors are rated from half to three-quarters horsepower, which means that they will develop that power constantly without heating, but for a brief period they may be worked to a very much greater capacity. Heating is the indication of danger with any electric motor.

Though the battery may be rated at six volts only, to illustrate, the amperage that may be turned into the motor may be extremely high. From one-half to one horsepower is necessary to turn an engine to a speed varying from 50 to 125 revolutions a minute, and statement may be made that an engine can be turned at 100 revolutions easier than at lower or higher speeds. To indicate the electric current necessary to drive a motor the reader may assume that three-quarters of a horsepower is required. As 746 watts equals one mechanical horsepower, 560 watts represents the current demand, and dividing the wattage by the voltage, six, this gives 93 amperes, plus, that would be drawn from the battery during the time the motor is in use. A half horsepower motor would require 62 plus amperes; a horsepower motor 124 plus amperes.

Three Forms of Coupling.

Westinghouse motors are coupled to the flywheels by pinions carried on the armature shafts that are moved in and out of mesh with the external ring gears on the flywheels by three forms of mechanism. The first of these is known as the non-automatic pinion shift. As will be noted from the diagram, there is a reduction gear between the armature shaft and the flywheel. The pinion of the armature shaft meshes with a gear that drives a shaft on which a pinion is slidably mounted, and this pinion can be either engaged with or disengaged from the flywheel by means of a shifting rod or link that is connected with a foot pedal. This rod carries a contacting member of the starting switch.

Reference to the diagram will show the operation of this mechanism. The contact making member of the switch is mounted directly on the gear shifting rod, though it may be mounted on any rod that is inter-connected so as to have the same movement. At A is shown the "off" position of the shift pinion and the switch contactor.



The Parts of a Westinghouse Starting Motor with Self-Contained Reduction Gearing.

Pressure upon the starting lever moves the shift rod first into the position shown at B, closing the motor circuit at P and P1 through the resistance R. The motor is then started at slow speed. When the shift rod is moved to the position shown at C the electric circuit is opened, but the motor and the pinion continue to turn from their momentum.

The Pinion Must Mesh with Gear.

At the position shown at C the pinion is turning slowly, so that it cannot fail to mesh quickly and easily with the gear, but as the power is off the motor there is no difficulty in sliding the teeth of the pinion into full engagement. As soon as the teeth do engage, the pressure of the foot on the starting lever shifts the rod to the position shown at D, closing the electric circuit at Q, after the pinion and gear have meshed a sufficient distance to have a good bearing length on the teeth. This connects the motor directly on the storage battery, so that full power is developed, and it turns the engine until the starting lever is released or the engine obtains greater momentum from its own power.

There is an over-running clutch between the flywheel pinion and the motor, so that if the pedal is not promptly released when the engine overtakes the motor in speed the motor is not driven by the engine. When the pressure is removed from the starting lever, the shifting rod is returned by the pressure of the spring to the position shown at A, which releases all gears and opens the electric circuit and the motor stops. When installed the travel distance for the switch rod is $\frac{3}{16}$ -inch for the auxiliary contacts to close, $\frac{1}{2}$ inch for the auxiliary contacts to open and the gears to start to mesh, $1\frac{1}{4}$ inches for the main contacts to close and $1\frac{3}{8}$ inches for the main spring to be compressed.

When Crankshaft Is Coupled.

The statements apply to systems in which the starting motor is connected to the flywheel by a shifting pinion. Where there are self-contained reduction gears with the motor these may be connected to the crankshaft by chains or gears and driven through over-running clutches. The clutch is sometimes in the motor gearing and sometimes on the crankshaft. Pressure upon a starting pedal closes the circuit through the starting motor and battery, and releasing the pedal cuts off the current from the motor. The switch that is used with this application is similar to that used with the automatic pinion shift. The reference to crankshaft coupling applies to some earlier systems.

Automatic Electro-Magnetic Shift.

The second type of coupling is the automatic electro-magnetic pinion shift. The motor armature shaft has an extension that is threaded with a quick-acting screw or thread on which is mounted a pinion that will turn on the thread until it reaches a definite position. This pinion will

move outward on the shaft until it is fully meshed with the gear of the flywheel when the motor begins to turn, and after the engine has developed speed the pinion is automatically turned backward on the armature shaft until it is clear of the flywheel gear.

A hand or foot-operated switch or an electro-magnetically operated switch controlled by a cir-

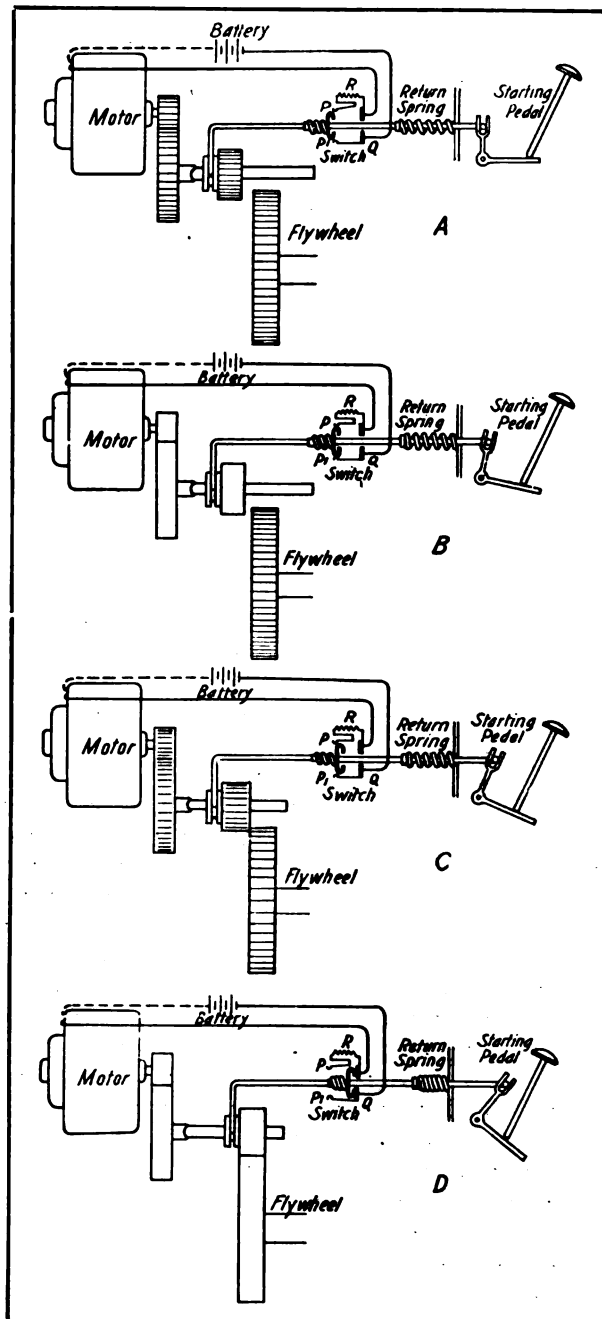


Diagram of Electrical and Mechanical Connections of Motor and Switch for Non-Magnetic Pinion Shift Flywheel Drive.

cuit closed by a push button switch, conveniently placed on the steering wheel, may be used. The movement of the pinion into engagement may be noted from the accompanying diagram. When the starting switch is closed, the full battery voltage is impressed on the motor, and it is started. The pinion, when the motor is at rest, is within

the screw shift housing, and entirely away from the flywheel gear. The threaded shaft is connected to the reduction gear shaft by a spring, which thus forms a flexible coupling. As the load is not large enough to compress the spring when the

the sketch the starting switch is closed, the circuit being completed from the negative terminal of the battery through the switch, the shifting magnet, the armature and the series field of the motor to the frame of the car, and through this to the positive terminal of the battery. The motors used with this system are a series type, the fields being connected in series with the armatures so that all of the current flowing through the one also flows through the other. One of the characteristics of this type motor is that the current flowing through it is proportional to the energy developed.

When the starting switch is closed the current flows through the circuit stated, causing the armature and the shaft to rotate. The

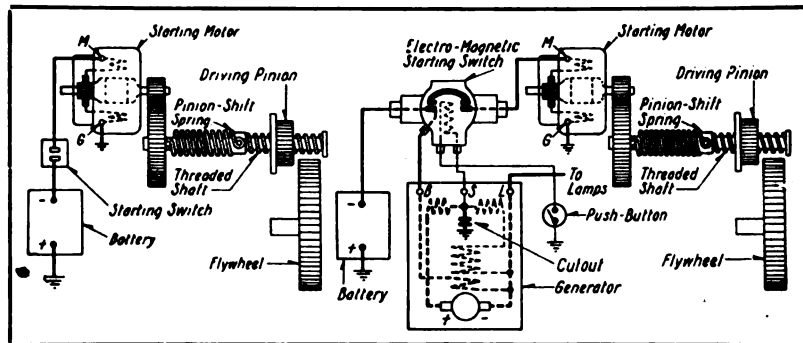


Diagram of Electrical and Mechanical Connections of Double Reduction Motor and Switch for Automatic Screw Pinion Shift: At Left, with Hand or Foot Operated Switch; at Right, with Electro-Magnetically Operated Starting Switch Controlled by Push Button.

motor starts, the threaded shaft is immediately revolved by the spring in released position.

Meshing Gears Cannot Clash.

The pinion moves out on its shaft by virtue of its revolving threads, until it reaches the flywheel. If the teeth of the pinion and the flywheel meet instead of meshing, the spring allows the pinion to revolve until it meshes with the flywheel. When the pinion is fully meshed into the flywheel teeth, the spring compresses, and when the pinion is then revolved by the motor as through a continuous shaft, turning the engine over. When the engine fires and the flywheel peripheral speed continuously exceeds that of the driving pinion, it forces the latter out of mesh and it is returned to its original position in the screw shaft housing. During the periods immediately after the engine has passed over any one of the points of maximum compression, the spring serves as an elastic cushion between the flywheel and the reduction gear, so the pinion will not be thrown out of mesh.

The third type, the automatic, self-contained electro-magnetic pinion shift coupling system, includes what is known as the shifting magnet. The motor armature is mounted on a hollow shaft, and on the end of the shaft is a splined pinion that drives the engine flywheel. This pinion is slidable on the shaft and is moved by a shifting rod that is attached to the pinion and passes through the hollow shaft. The other end of the rod serves as a core for the shifting magnet. When the motor is not revolving a return spring holds the pinion at the end of the shaft, clear of the flywheel gear.

The operation of this device is shown diagrammatically. In

motor requires a high current at the instant it starts from rest, which energizes the shifting magnet sufficiently to overcome the force of the return spring, and draws the sliding rod through the shaft, thus sliding the pinion into mesh with the flywheel gear. The teeth of the pinion and the flywheel are helically cut to mesh easily. As soon as the pinion meshes with the flywheel gear, the current required to turn the engine is strong enough to hold the pinion in mesh until the engine fires regularly.

Motor Disengages Its Pinion.

When the engine speed approaches the no-load speed of the motor, the current in the latter falls off so that the pull of the shifting magnet is less than that of the return spring, which throws the pinion clear of the flywheel. The motor will continue to revolve, without load, however, until the starting switch is opened or released but the pinion remains out of mesh, because the current required to turn over the motor is not enough to energize the starting magnet sufficiently to pull the pinion back into mesh against the force of the return spring.

(To Be Continued.)

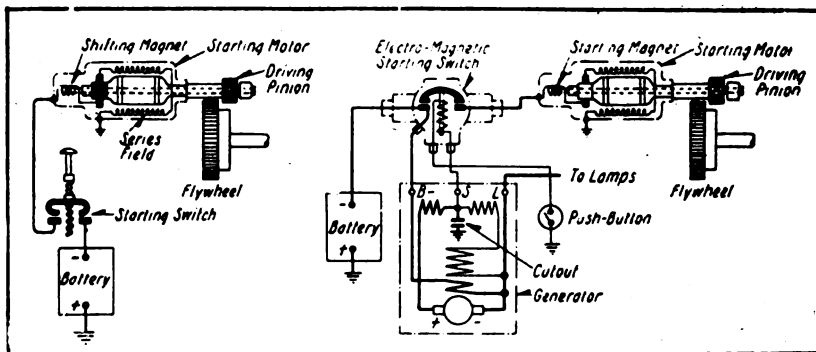


Diagram of Electrical and Mechanical Connections of Motor for Automatic Electro-Magnetic Pinion Shift: At Left, with Hand or Foot Operated Starting Switch; at Right, with Electro-Magnetically Operated Starting Switch Controlled by Push Button.

TIMING THE VALVES AND THE IGNITION SYSTEM.

A Non-Technical But Practical Discussion of a Subject of Much Importance to All Car Owners Who Make Their Own Repairs and Adjustments of These Components.

IT SEEMS to be a practise among owners of pleasure and commercial gasoline vehicles to make minor repairs from time to time. As a common result some soon believe themselves learned enough in the construction of the machines to conduct a thorough overhauling. Some do very satisfactory work, but in the majority of cases much trouble is experienced in retiming the valves and ignition.

Taking it for granted that the owner has placed every other part of the machine in perfect condition, the full efficiency of any motor cannot be obtained unless the functioning of the ignition system and the valves is in perfect synchronism with the strokes of the pistons in the cylinders. Timing is tedious work, but the novice should not be easily discouraged. It often tries the patience of even the most skilled workman.

The first step concerns the valves—it would be useless to attempt to time the ignition without first obtaining their correct working relationship with the pistons. Consider first the effect on the motor if the opening and closing of the valves should take place at wrong intervals. Should the exhaust close too early there would be a quantity of burned gas left in the cylinder when the intake opens. The result would be that this gas, which should have been forced out of the cylinder, will be driven through the open intake valve and into the carburetor. This would affect the mixture and also cause backfiring at the carburetor and make it possible for fire to occur.

If the exhaust valve was to close too late, a weak mixture would be the result, because the intake valve would not commence to open until the piston had partly completed its downward stroke. Back pressure is another condition brought about by the exhaust valve opening too late. The reason for this is that the piston starting on its upward, or exhausting stroke, is resisted by the burned gases, which cannot escape until the exhaust valve opens.

Practically all motors now in vogue are of the four-cycle type. By this is meant that four complete strokes of each piston is required before its full quota of power is contributed to propelling the car. These strokes in the order of their occurrence are known as follows: The intake, the compression, the power and the exhaust strokes.

Regardless of the number of cylinders which may be used to compose the motor, the number of strokes which the piston must make to deliver one power impulse is always the same. At the beginning of these strokes the intake valve, if correctly timed, will open to admit gas to the combustion chamber, which is drawn in by the suction created by the passage of the piston. At or near the end of the completion of the downward

stroke, the inlet valve closes and produces a perfectly air tight cylinder. As the piston comes up on the second, the compression stroke, the gas is compressed. At the apex of this stroke, a properly timed spark takes place in the combustion chamber and ignites the tightly compressed gas. The expansion caused by combustion results in pressure that forces the piston on its downward or power giving stroke.

The principle of this is that pressure will always follow the channel affording the slightest resistance. In the gasoline engine cylinder the piston is the part offering the least resistance and consequently it is forced down. When the piston has reached the lowest point of its travel on the power stroke, the exhaust valve, if properly timed, will open so that the burned gases can be expelled into the exhaust manifold by the upward stroke of the piston.

It may be well to state here that it is impossible to set an arbitrary rule for the timing of motors, because all engines are not timed alike. The principle, however, does not vary greatly from the following and it can without doubt be applied in general.

In the four-cylinder engine the crank case has four cranks, which are a half revolution or 180 degrees apart. If this is the condition, then there must be an impulse or power stroke at each half revolution of the crankshaft. The common practise is for the power strokes to be delivered in the order named; first, third, fourth and second.

Either one or two camshafts may be used in this type of engine. If the motor is of the L head type, all valves are situated on one side and are operated by a single camshaft. If the exhaust valves are on one side of the engine and the intake valves on other side of engine, it is said to be of the T head type and two camshafts must be used. Let us consider the motor having all valves on one side.

Securely attached to the end of the camshaft is a gear directly meshed with another gear which is securely attached to the end of the crankshaft. The gear attached to the end of the crankshaft has but half as many teeth as the one attached to the end of the camshaft, thus it is obvious that while the crankshaft is completing a full revolution, the camshaft turns through but half a revolution. This gear reduction is made necessary, as each piston must complete four strokes for the deliverance of its impulse to the shaft. It is now general practise to form

the cams on the shaft and so any change in adjustment of the camshaft with respect to the crankshaft will not only effect one valve, but all of them.

The first operation in valve setting or timing is to record the dead centre lines on the flywheel. On late models this point is marked, but if not, it is not difficult to determine it. This operation is easily accomplished on any two or four-cylinder engine, as the points on the flywheel will be diametrically opposite.

The dead centre of the pistons of most four-cylinder engines is obtained when the pistons of the first and fourth or second and third cylinders are at their highest point of travel. This can be ascertained by inserting a piece of wire through an opening in the cylinder head until it contacts with the head of the piston. By watching when this wire

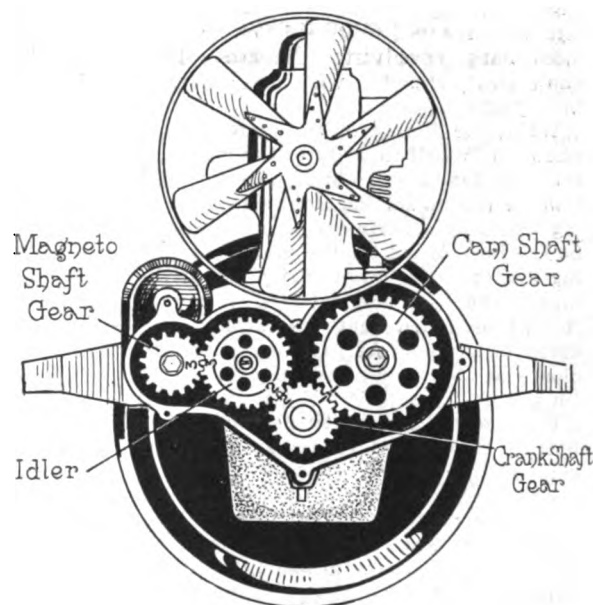


Fig. A—Timing Gears on Modern Cars Are Marked, as Shown Above, and Insure Perfect Synchronization.

starts downward with the piston, one can determine when that piston has passed the apex of the stroke. Another good method is to open the relief cock on the cylinder head and place an end of a rubber tubing over the cup. The other end should be placed in a tumbler filled with water. It is easy to determine that the piston is travelling upwards on its compression stroke by the fact that the intake and exhaust valves of that cylinder will be closed. Turn the motor over very slowly and note the bubbles rise in the tumbler of water. When they cease it is positive proof that the piston has reached its highest point of travel, and the flywheel should be marked indelibly with reference to some point on the motor. The number of the pistons to serve as a guide for the future at top centre should be marked on the flywheel beside each

centre mark. Thus if those in the first and fourth cylinders are at top centre, the figures, 1 and 4, should be placed over

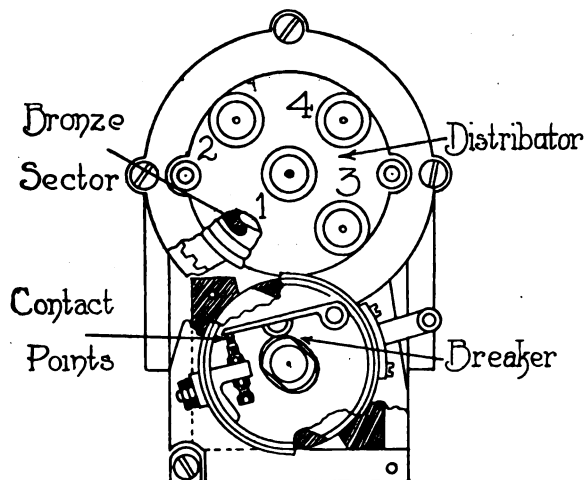


Fig. B—Position of the Distributor Segment and the Breaker Contact Points When the Charge in the Cylinder Is Ready to Be Ignited.

the mark. The figures, 2 and 3, should, of course, be placed beside the centre mark, which is diametrically opposite from this, because when this mark registers with the notation made on the cylinder flange, the pistons in the second and third cylinders will have reached their highest point of travel.

When the timing of the motor is not known it is well to write to the manufacturer or dealer and obtain this information, as the maker has adapted that timing which by experiment he has found to be the best suited for the motor. A timing diagram of a large engine not of the high speed type is illustrated in Fig. D. It will be noted that the intake valve opens at five degrees past top centre and closes at 15 degrees past bottom centre. On the next revolution of the crankshaft the exhaust opens at 30 degrees before bottom centre and closes at top dead centre.

The diagram shown in Fig. E illustrates the proper valve timing of a well known car. A simple comparison of the two timing diagrams already shown will substantiate the fact that it is impossible to give an arbitrary rule for timing all motors. In Fig. E the angles past the dead centre lines at which the intake and exhaust valves open and close are clearly shown. It will be seen that the intake valve starts to open at five degrees past the dead centre line and closes at 30 degrees past the opposite dead centre line. The first two strokes of the piston represent the suction and compression strokes respectively. The next in sequence is the power stroke, and the fourth, or the last half of the second complete revolution of the flywheel, represents the exhaust stroke. In this motor the exhaust valve starts to open at a point about 14 degrees past the dead centre line and closes on dead centre.

As stated before, the timing adapted by the manufacturer of the motor must be followed. If it is not already marked on the flywheel it is a simple matter after obtaining the desired information to mark the wheel. In any circle there are 360 degrees and if the circle is divided

into quarters, each quarter will represent 90 degrees. If the quarter is divided into halves, each will represent 45 degrees.

This process can be followed until the circle is divided into the desired number of degrees.

To determine whether a valve is or is not fully closed, the operator should attempt to pass a thin piece of paper between the valve stem and the valve push rod. If the paper can be placed between the two, the valve is fully closed.

It has always been common practise for the manufacturer of the motor to mark the meshing point of the camshaft and crankshaft gears after the motor has been assembled and the correct timing obtained. For example, two teeth on the crankshaft gear may be centre punched at the side as would be one tooth on the camshaft gear. By placing the indented tooth on the camshaft gear between the two indented teeth on the crankshaft gear, the former is compelled to operate in the proper relationship to the latter.

Let us now consider the extreme case where the timing gears are not marked. It will be necessary for the owner to make a rough estimate as to how many teeth the camshaft gear will have to be turned so that the proper timing may be reached. Having done this and then meshed the gears, mark the meshing points with a piece of chalk. Test the timing next and if it is found to differ with the manufacturer's instructions, remove the crankshaft gear; but be careful not to shift the position of the crankshaft.

The next operation is to rotate the camshaft gear one tooth or more at a time, as the case may necessitate, in the proper direction. The crankshaft gear must then be replaced and the timing retested. This is the operation which was previously referred to as trying to the workman's patience. It is imperative that the relationship of these gears be exactly what the maker intended or the full efficiency of the motor cannot be obtained. If a valve opens too early, it will close too early, and if it opens too late, it will close too late. This is a positive indication that a proper relationship between the camshaft and crankshaft gears does not exist.

If it is found that the timing of the valves is irregular, that is, most of the valves open and close on time while others are late or early, the remedy cannot be effected by adjustment of the gears, but must be made by adjusting the individual push rods. The majority of manufacturers have made some provision for the lengthening or shortening of the push rods. Con-

sider that all the valves appear to be properly timed, except one, which opens too early and closes too late. The remedy for this is to shorten the push rod. The result is obvious. The rod will engage the stem of the valve later and when descending will disengage it sooner. Always bear in mind that perfect synchronism can only be obtained by accurate timing. Be patient and never consider the operation completed until the marks on the flywheel, which represent the correct angles past the dead centre lines, are in accurate register with some set mark on the cylinder flange or crank case, as the case may be.

Timing the ignition does not merely mean the occurrence of a naked spark in the cylinder when there is a fully compressed charge of gas stored there. In its broadest sense the term means the firing and expansion of the charge. Although slight, there is a difference between the time at which the electric spark takes place in the cylinder and the time at which the gas fully expands. There is also a slight interval between the contact at the ignition timer and the time when the spark actually takes place in the cylinder. This slight interval is generally referred to as the lag.

To offset this lag at different engine speeds, it is imperative that the commutator or timer be proportionally advanced. This is essential regardless of whether it be a battery or magneto system. This is the reason why the spark lever is usually placed on the steering column, where it can be operated as the driver feels necessary. These slight intervals vary according to the engine speed and only by experience can the operator determine the correct location of the lever so that the proper advance may be made for the different engine speeds. The advancement will also vary according to the design of the motor, amount of compression, condition of the coil, etc.

Almost every driver has attempted to climb a very steep incline with the spark lever fully advanced. As the speed of the

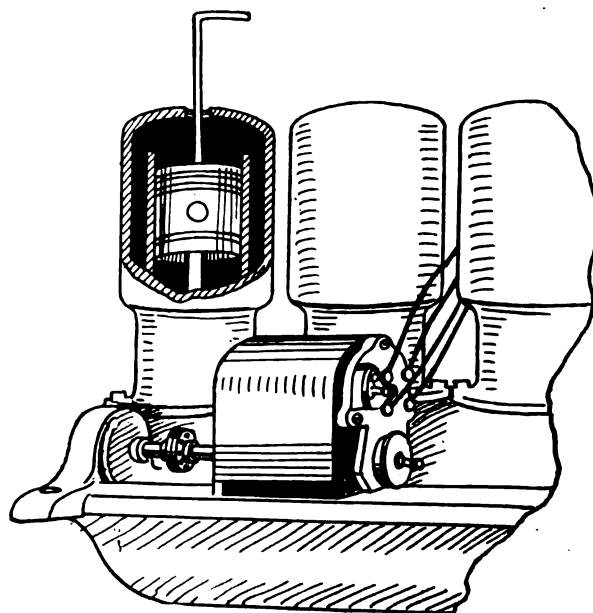


Fig. C—Relative Location of Piston and Distributor Sector in Timing the Magneto.

motor decreases, a very distinct knocking sound is heard. The reason for this is that complete combustion occurs too

gears if other methods can be used. For this reason the following method is much the better and also simpler.

It consists of lengthening the advance rod. This forces ahead the contact point in the commutator shell instead of the roll. The result, however, is the same.

In some instances it will be necessary to shorten instead of lengthen the advance rod. This can be determined by the type of advance used. By this is meant that on some cars the advance is made by drawing the lever down, while on others it is made by pushing the lever forward. As the contact points are properly spaced in the commutator shell and cannot possibly be moved, it is only necessary to time the ignition for one cylinder. The remainder are regulated automatically.

To time the magneto, assuming that it has not been disassembled, but merely removed from the car, break

the driving point and turn armature shaft until bronze sector in the distributor just begins to register with the contact point that supplies the current to the cylinder being timed. The direct connection to the engine should then be made with the points in this described position. If the magneto drive shaft has been removed from the car, it may be necessary to remesh the gear at the end of the shaft so that a proper connection to the magneto can be made. As in the case of battery ignition, it is only necessary to time the ignition for one cylinder to produce the correct timing for all cylinders.

Before disassembling any vital part of the engine, such as the timing gears, the operator can save himself much trouble and expense by first marking the meshing points of the gears with a small punch mark. He should also make sure that all connections are tight before deciding the gears are wrongly meshed.

SHIFTING NON-SKID TIRES.

A method of keeping comparatively new and efficient non-skid tires on the rear wheels of a car during wet and slippery weather is suggested by R. S. Wilson, of the Goodyear Tire and Rubber Company. He says that the ordinary car uses up about a set and a half of tires during a year. Non-skids should be purchased in the winter and applied to the rear tires. When they have worn down smooth they should be shifted to the front and the new ones placed on the rear.

Those tires which are not yet sufficiently worn when they are removed from the front wheels under this progressive process can be saved until summer, when the

need of non-skid tires is not so great. He also suggests that in driving on frozen roads the ruts be avoided, as they are likely to wear the side walls of the tire. When once these walls have been sufficiently worn so that the fabric is exposed they deteriorate rapidly and blowouts will occur.

RADIATOR HOOD.

Because of the high price of gasoline, the car owner of moderate means has to give much thought to the economy of operation. During cold weather the majority of owners are using an anti-freezing solution in the water of the cooling system. This solution will resist freezing even in the lowest temperature, but it is of no assistance to starting the motor.

Hard starting is a common complaint of motorists during cold weather. When it is necessary to start a cold motor, much gasoline is wasted. The fuel cannot be readily mixed with the air and much raw gasoline is deposited in the cylinders in the form of carbon. A secret of gasoline economy is to keep the motor warm when it is not in operation.

The average automobile is used, but approximately five per cent. of the 24-hour day. Ordinarily it is driven a short distance and then left idle in the cold while the owner attends to his business. Often it is allowed to stand for three to five hours, and during this period of idleness the motor becomes cold and, of course, difficulty is encountered when starting it and the fuel is wasted.

There are numerous types of hood and radiator covers on the market which can be purchased at a nominal cost, and will retain the heat and prevent the wind from blowing through the radiator. The chief remedy for hard starting is heat.

ALCOHOL IN RADIATOR.

To prevent the water of the cooling system from freezing many car owners add large quantities of denatured alcohol. Alcohol gives off an inflammable gas. Consequently, when attempting to determine the amount of water in the cooling system, never hold a lighted match in the mouth of the filler hole in the radiator.

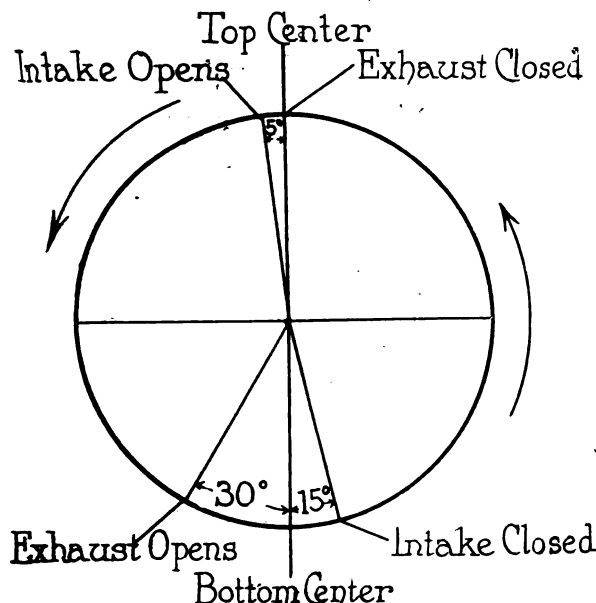


Fig. D—Timing Diagram of a Medium Speed Large Motor.

early in the cylinder, which but for the momentum of the car would cause the engine to operate in a reverse direction.

As when setting the valves, there are several methods of timing the ignition. The simplest is to turn the engine over slowly by hand until the piston of No. 1 cylinder reaches its highest point of travel on its compression stroke. The method for doing this has been described in the chapter on valve timing. Now turn the engine over by hand until the piece of wire, which is passed through the head of the cylinder, descends for about a half inch. With the spark lever retarded to its fullest point, a spark should occur at the plug.

Although it is always said that the spark should take place at the height of the compression stroke, this is poor practise, because it would endanger the safety of the operator when cranking the motor by hand. It is obvious that when starting the motor by hand crank the flywheel at the end of the crankshaft has not developed sufficient momentum to prevent the piston being driven in a reverse direction should the spark take place a trifle early. Therefore, for the sake of safety, the spark is timed to take place a trifle after dead centre.

Consider first the ordinary battery type of ignition. If the spark does not appear at the plug in the cylinder when the piston is at the point in the cylinder as just stated, the commutator roll should be loosened and moved forward until it just registers with the contact point in the commutator shell provided for that cylinder. If the roll is keyed to a shaft, it will be impossible to loosen and move it forward in the manner just described. One remedy is to remesh the gear at the end of the commutator shaft and move it forward a tooth or two as the condition may warrant. This would move the roll ahead so that it would engage the contact point earlier.

It is poor practise, however, to remesh

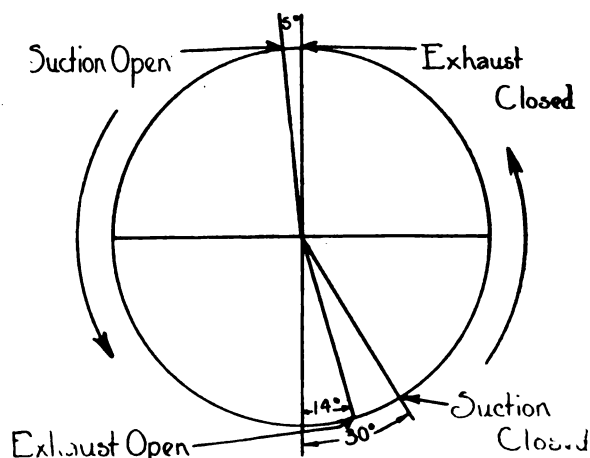


Fig. E—Timing Diagram of a Well-Known Motor Which Differs Greatly from That Shown in Fig. D.

MOTOR CAR ACCESSORIES AND EQUIPMENT.

LEWIS NOJAR AUTO CLOCK.

The Lewis Nojar rubber encased auto clock is entirely encased in pure red rubber, only the face being visible. Besides absorbing all road vibrations, the rubber case prevents dust and dirt from shifting into the mechanism. Rubber is also non-conductive and positively protects the instrument from all electrical disturbances.

The clock is of a stem wind type and is guaranteed for two years. Any defective part will be repaired or replaced free of charge within that period. The instrument is extremely attractive in design and harmonizes with the appointments of the most luxurious car.

The Lewis Nojar is made by one of the largest and most reputable clock manufacturing concerns in this country. By ordering the clock in lots of 10,000, the company has been able to obtain them at a price sufficiently low to place them on the market as a motor necessity rather than a luxury.

The clock is adapted to any make of car, one model being made exclusively for Ford cars. The Ford clock attaches to the steering wheel, while the others attach to the dash.

Manufactured by the Pennsylvania Rubber Company, Jeannette, Penn. Prices will be supplied when requested.

YANKEE PUMP.

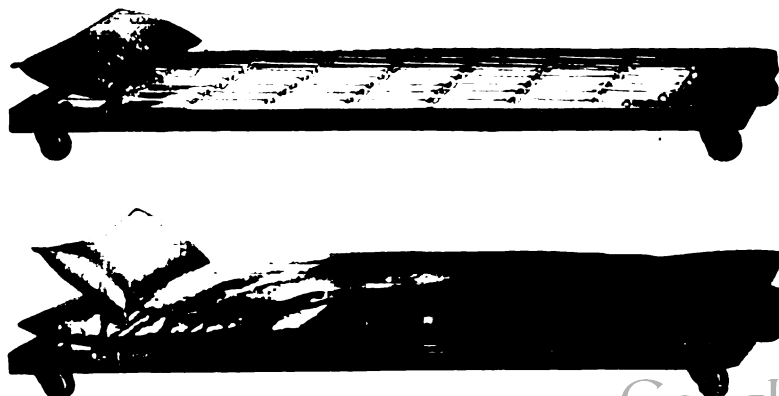
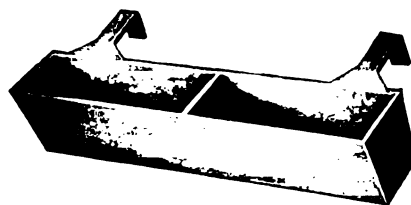
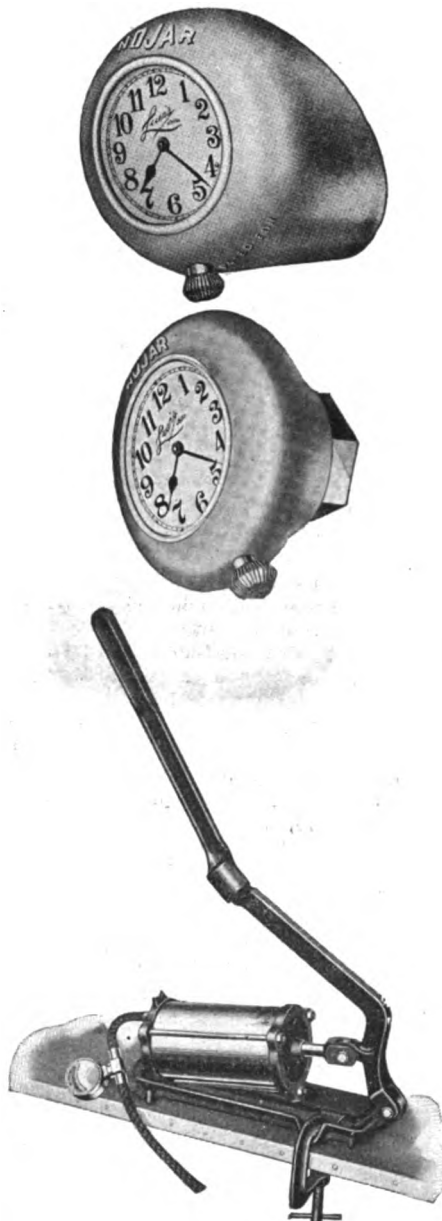
The Yankee folding running board hand pump has a powerful seven to one leverage and a capacity of 36 cubic inches of free air per stroke. It is equipped with a non-porous leather piston that insures a pressure of 200 pounds per square inch without the air leaking through. It is also treated to make it non-drying, and being very heavy, the leather retains the non-drying fluid for a long time. Statement is made that with proper care, this pump will outwear the car. It is finished in black and brass and will not tarnish or chip.

When not in use the Yankee pump folds compactly and can be conveniently carried in the tool box of the car. When needed it can be quickly clamped to either running board.

Manufactured by the Apex Electric Manufacturing Company, 1410 West 59th street, Chicago, Ill. List price \$4.50, including eight feet of linen covered hose.

AUTO REPAIR COASTER.

The outstanding feature of the Foster "Ideal" auto repair coaster is that comfort is afforded the workman regardless of the limited space in which he may be working. It is made with a strong angle iron frame from which a high-grade link fabric spring is suspended. This is covered by a full length cushion and head rest. The frame is re-enforced at the corners by heavy castings, forming rounded corners. These castings insure durability. They extend from the corners



about six inches both ways under the angle iron of the frame. With the casters, these castings are securely riveted to the frame by six large rivets.

The pad and pillow are filled with a fine, soft cotton and are covered with a heavy black oil cloth. With each coaster is supplied a movable cast iron small parts holder, which can be readily hung from any position on the side rails.

The coaster operates very easily. The manufacturer declares that due to the strong metallic construction, it is virtually unbreakable and will last a lifetime. It is clean, sanitary and comfortable. The finish is in black japan, which is baked on.

Manufactured by the Foster Brothers Manufacturing Company, St. Louis, Mo., and Utica, N. Y. List price, \$2.50 with pillow only, and \$3.75 when equipped with pillow and pad.

NEW SPLITDORF PLUGS.

The well known line of Splitdorf Common Sense spark plugs has been increased by the recent addition of the Metz Special and Heavy Hex types.

The Metz Special has a core of high grade, imported mica, wound lateral on a taper steel central electrode, the upper part of which is protected by a hexagon porcelain cap. The sparking points are composed of 98 per cent. pure nickel and they are made extra heavy. The steel shell is $\frac{7}{8}$ -inch in diameter; the threaded part is standard $\frac{1}{2}$ -inch pipe, extended one inch.

The steel shell of the Heavy Hex type is $1\frac{1}{4}$ inches in diameter and the thread is standard S. A. E. $\frac{7}{8} \times 18$, one inch long and fitted with a copper asbestos gasket.

Manufactured by the Splitdorf Electrical Company, 98 Warren street, Newark, N. J. Prices and further descriptive matter will be supplied upon request.

MIDGET MOTO-METER.

A new model of the well known Boyce Moto-Meter has just made its appearance. This new model is a small instrument designed for use on Ford, Maxwell and similar cars, and is designated as the Midget Boyce Moto-Meter.

The manufacturer states that on ac-

count of the low price at which it will sell and also the high-grade finish of the instrument, it is expected to prove very popular with the trade and motoring public. The popularity of the Moto-Meter is well illustrated by the fact that during 1915 each month showed a steady increase in volume of sales. Twenty-seven of the leading car manufacturers will use Boyce Moto-Meters as standard equipment during 1916.

Manufactured by the Motometer Company, Inc., 1790 Broadway, New York City. List price, \$2.50.

TIRE CHAIN HOOKER.

The Foster tire chain hooker greatly simplifies the operation of attaching Weed chains to the wheels. Two hooks of the tool engage the chain links on either side of the fasteners and all slack is easily taken up by simply drawing the two handles together. When the chain is drawn sufficiently tight so that the two ends overlap, the operator slips the ratchet into a notch and the tool will retain the chain in the position as shown in the illustration. It is then a simple matter to clamp the chain fasteners.

The tool is also helpful for removing chains, especially if they are muddy or rusty. It is 13 inches overall and folds compactly to go into the tool box. It is finished in black japan.

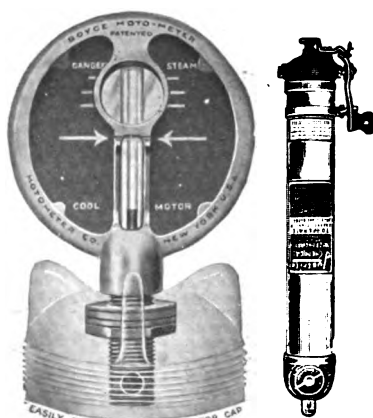
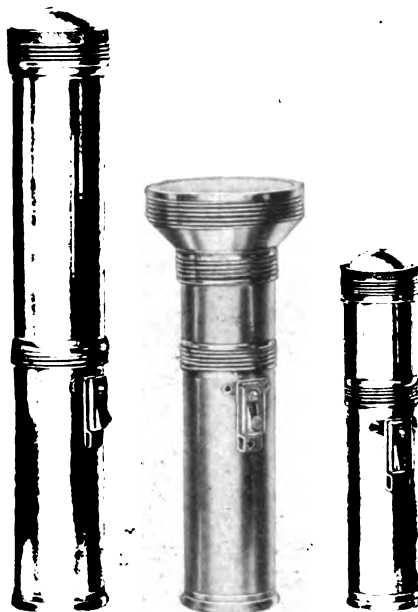
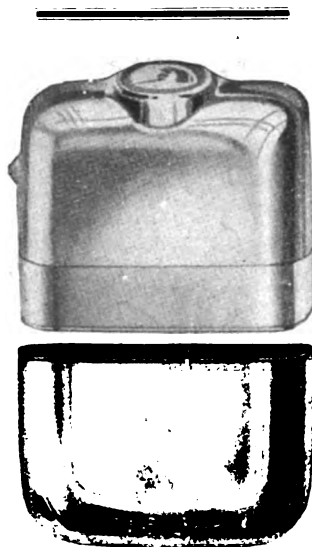
Manufactured by the Foster Brothers Manufacturing Company, St. Louis, Mo., and Utica, N. Y. List price, 50 cents.

KWIK-LITE FLASHLIGHTS.

Kwik-Lite electric flashlights are made in a wide variety of styles and sizes, and include types ranging from fiber to metal in nickel, statuary bronze, gun metal, silver and gold finishing. The two designs shown herewith are the Kwik-Lite metal tubular flashlight and the Kwik-Lite metal vest pocket flashlight.

The metal tubular flashlights are non-short-circuiting. The cases are strongly made, from the best of materials. They are made in two parts—each being drawn into shape from a solid sheet of brass—the upper piece telescoping the lower, and securely joined by means of

The prices given in connection with these descriptions of accessories and equipment are the latest retail quotations by the manufacturers or distributors, and they are subject to change without notice. When addressing the manufacturer or distributor always mention The Automobile Journal to insure immediate attention.



screw threads. This gives maximum strength and harmony in line. It is easy to insert the battery, which is done by merely unscrewing the two parts.

The possibility of short-circuiting the battery through contact with other metal objects is eliminated, as improved methods of insulation have been provided. The reflectors are scientifically designed to project an intense ray of light.

The Kwik-Lite metal vest pocket flashlights have cases of the latest design. There are no hinges or clasps on the entire case, thus eliminating all danger of torn pockets. They are exceptionally attractive. Like the above mentioned Kwik-Lites, the vest pocket type is also drawn from a solid sheet of metal. The lower part telescopes over the upper and when pushed together the parts lock firmly. With a slight pressure on the side of the case, the two pieces can be pulled apart, making it easy to insert the battery. The vest pocket models are supplied in the same attractive finishes as the metal tubular ones.

Manufactured by the Usona Manufacturing Company, 1 Hudson street, New York City. Prices quoted on request.

Every person interested in reducing friction in the working parts of motor vehicles, and every owner and operator surely is, should ask the Joseph Dixon Crucible Company, Jersey City, N. J., for its new booklet concerning automobile lubricants. It contains several valuable suggestions as to proper lubrication and discusses the different kinds of lubricants. Ford car owners will be particularly interested in the company's manual, the title of which is "Proper Lubrication for Ford Cars." Both are sent free upon request.

JUSTRITE FIRE EXTINGUISHER.

The Justrite chemical fire extinguisher is guaranteed to extinguish all fire, regardless of origin. It is a seamless brass tubing, 1 9/16 by 2 1/2 inches. It has capacity for one quart of Justrite fluid, which is discharged by a small crank, located at the bottom of the tube, that operates in a clock wise direction. The pumping mechanism is absolutely mechanical and the parts are warranted to be non-corroding if only Justrite fluid is used. Statement is made that by turning the crank at a high speed it is possible to develop a pressure equivalent to 300 pounds to the square inch. This makes it possible to cast a stream a distance of from 25 to 30 feet. A soft wire seals the crank and safeguards the machine against tampering. The amount of fluid in the extinguisher is shown by an indicator.

Justrite fluid is harmless to machinery and the most delicate of fabrics. It is a non-conductor and is, therefore, safe to use for all electrical fires. It is said that one quart of this fluid will generate several thousand feet of fire killing gas, which is about five times as heavy as air.

Manufactured by the Justrite Manufacturing Company, Clinton and Van Buren streets, Chicago, Ill. List price of polished extinguisher, \$7; nicked plated type, \$8.



MASTER CALORITE PLUGS.

The discovery of the new insulating material known as calorite, which will not break under the most extreme heat and cold conditions, is the latest development in spark plug construction. This insulator is used in Master spark plugs and was only adopted after many severe tests. The plug was first heated until white hot, then plunged into cold running water. This sudden change of temperature had no effect on the calorite insulator and neither was there any signs of fracture when this alternate heating and cooling was repeated 10 times.

The break down test was next conducted. This test consisted of heating the plug to a bright red heat and then instantly plunging it into cold running water. This test was repeated 26 times without fracture to the calorite.

The ordinary porcelain insulator was next subjected to the same test, but broke before reaching a white heat. Calorite was also subjected to a severe electrical test and was found to withstand a 10 per cent. higher voltage than the finest porcelain obtainable.

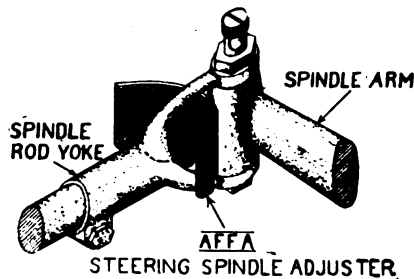
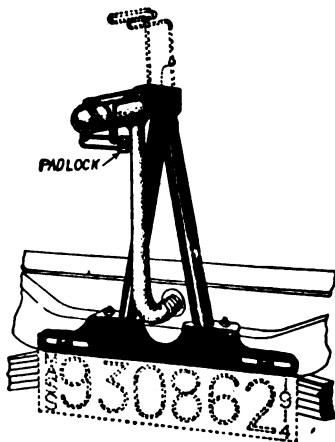
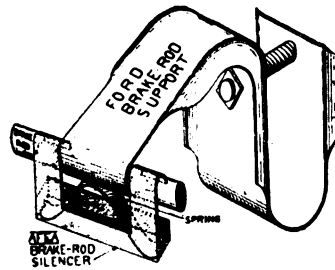
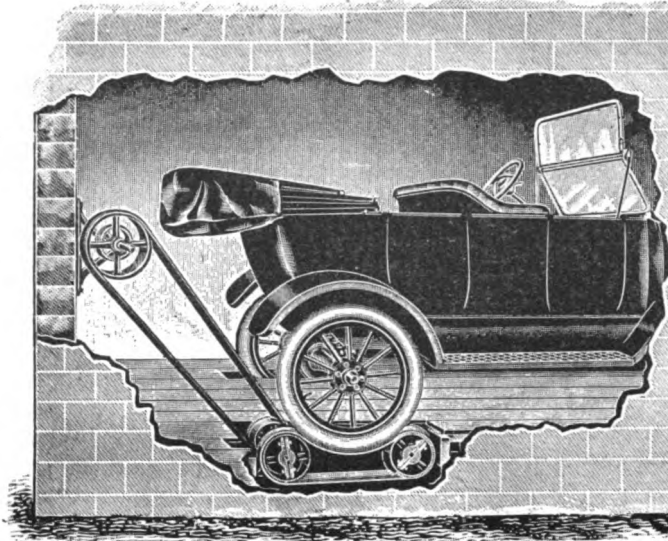
Manufactured by the Hartford Machine Screw Company, 508 Capitol avenue, Hartford, Conn. Complete information will be supplied on request by the maker.

AUTO POWER TRANSMITTER.

The Beard auto power transmitter is designed to take nearly the full power of an automobile motor and to deliver it to run any kind of machinery that can be run with a belt. The device consists of two shafts running in suitable bearings. The shaft from which the power is taken is stationary to an angle iron frame, while the other shaft bearings are adjustable so as to accommodate the different sizes of automobile wheels.

On each end of the shafts is a pulley and around these pulleys is a belt, loosely mounted to provide ample tension and surface. This protects the tires from injury.

The front shaft of the power transmitter has a lock, which allows the front shaft to be secured so that it will not rotate, thus enabling the car to be driven



out of the garage under its own power. When desired to have the transmitter stationary, it is placed under the floor, as shown in the illustration. The opening should be large enough to permit the automobile wheels to drop in on the belt and pulleys. When not in use a strip of flooring can be used to cover the transmitter so that it is out of the way.

Manufactured by the Beard Auto Life Manufacturing Company, Pleasant Lake, Ind. Write for prices.

AFFA ATTACHMENTS.

The three Affa specialties illustrated herewith are designed to be applied to the Ford car. The Affa brake rod silencer can be attached instantly without tools and without removing the brake rod support from the radius rod. It prevents rattle and is guaranteed to give satisfaction for the life of the car.

The Affa combination holder retains the front license number and also holds the starting crank upright, away from the mud and dirt. It is made of either aluminum or malleable iron and is light, strong and ornamental. It can be attached to the car by two nuts. The crank is secured in the upright position by a padlock. When the lock is removed a wire clamp springs up automatically and releases the handle. This appliance does not prevent the spinning of the motor by the hand crank. It is finished in black enamel. Special padlocks with two keys can be obtained.

The Affa steering spindle adjuster is designed to make steering sure and safe. All wear in the spindle arm connections is automatically taken up, which prevents the front wheels from wobbling. Statement is made that the saving in tires alone will greatly offset the price of the device. It can be installed in a few minutes and without machine work. It is guaranteed for the life of the car.

Manufactured by W. S. Graffam, Northampton, Mass. List price of brake rod silencer, 35 cents a pair; of combination holder, \$1 in malleable iron and \$1.25 in aluminum; of the steering spindle adjuster, 50 cents a pair.

RAJAH WATER PROOF PLUG.

The Rajah water proof spark plug, shown in the accompanying illustration, is of the same general construction as the Rajah plug that has been in successful use for a long time. Incorporated in its construction is a heat resisting condensate protecting part, which screws to the plug bushing, and also a special nipple which covers the brass clip terminal on the cable.

The plug is warranted to be water proof under all conditions. For that reason it has been adopted as the standard plug for Curtis aeroplanes. It can be obtained in all standard sizes with the Rajah terminal, which is adapted to all cables.

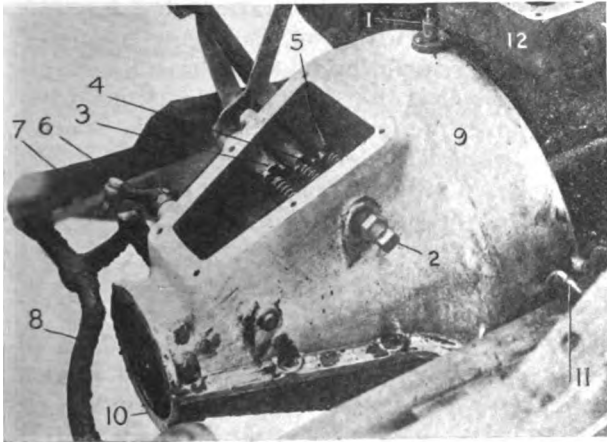
Manufactured by the Rajah Auto Supply Company, Bloomfield, N. J. Write for prices.

SUGGESTIONS FOR THE FORD CAR OWNER.

Removing the Universal Joint Cap, the Transmission Housing and the Engine Block, Leaving the Crankcase in the Chassis Frame, which Greatly Lessens Labor.

The 42nd article dealing with the operation, construction, maintenance, care and repair of the model T Ford chassis is the third of the series devoted to adjustment, restoration and overhauling.

WHAT has been described in the previous installments would be necessary for merely cleaning the cylinders and pistons and grinding



Ford Transmission Case with Cover and the Universal Joint Cap Removed.

- | | |
|-----------------------------|--------------------------------|
| 1—Magneto Contact Assembly. | 7—Speed Lever. |
| 2—Slow Speed Adjusting Nut. | 8—Controller Shaft. |
| 3—Brake Pedal Shaft. | 9—Transmission Case. |
| 4—Slow Speed Shaft. | 10—Universal Joint Cap Flange. |
| 5—Reverse Pedal Shaft. | 11—Crank Case Support Arm. |
| 6—Clutch Lever. | 12—Cylinder Block. |

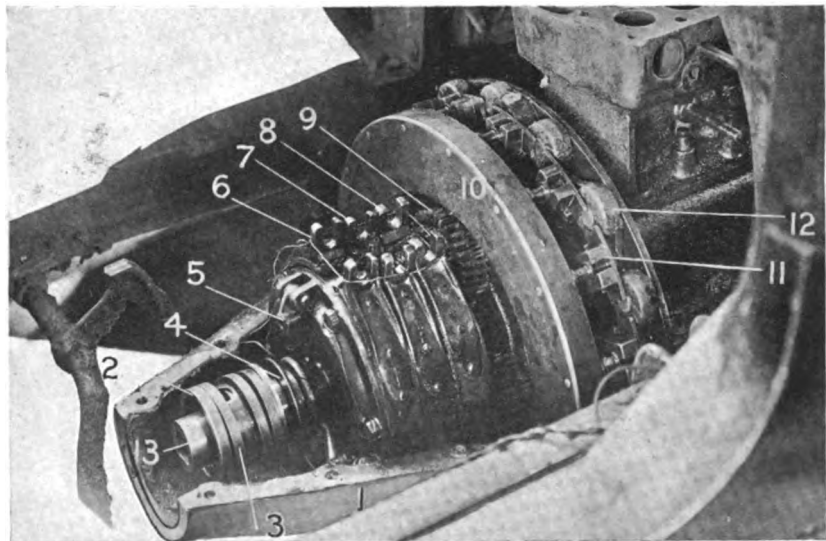
the valves, and for this reason removal of the carbon has been dealt with, but the valve grinding will be considered later on. If the engine block is to be taken from the chassis for other work, the removal of the carbon from the head of the casting and the pistons and valve ports had best be left until the block is removed. The cylinder head must be taken off in any event, and this can be done quite as easily before the engine is out of the frame.

Preliminary to taking out the engine block the bench should be made ready for it. The casting is heavy and cannot be easily handled by one man unless he is accustomed to working on engines. A bench is not convenient to work at the unit because it must be turned to get at all sides. A frame is really neces-

sary if the entire engine is to be removed from the chassis, because it must be supported practically the same as when it was in the car frame. A frame can be made of two pieces of 2x4 timber placed with the ends upon horses, or with the ends upon a bench or a horse, the ends being solidly fixed by nailing the timber. Should the timber be spread in handling the result might be serious. There should be a cross piece to support the forward end of the engine case, and this should also be nailed securely.

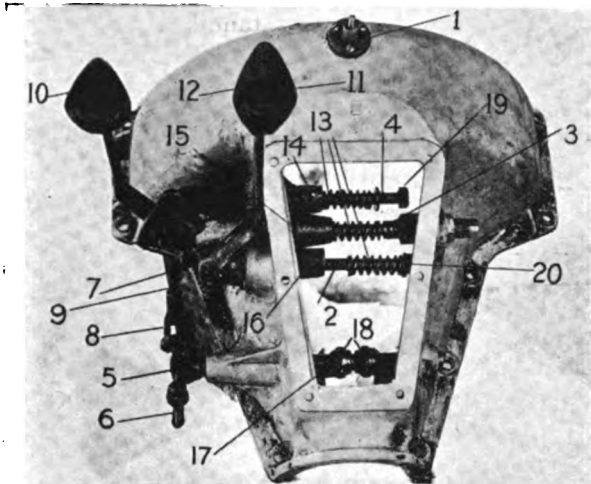
With such a frame one can work on all sides and under the unit, but there is seldom need for taking the entire engine from the chassis. There are no moving parts in the lower section of the engine case and no good purpose can be served by taking it out. Not only this, by simply taking off the cylinder block and the flywheel and transmission assembly the weight is considerably reduced and less space is required, so that a stout barrel will meet every requirement for working on it. The barrel is comparatively light, can be moved easily and is substantial enough for all purposes. When the barrel is used as a stand for the engine it is supplemental to a bench, for which there is abundant need.

For an overhaul, however, the engine ought to be disassembled, and the first work is to take out the four bolts that secure the universal joint cap



Ford Transmission Case Removed, Showing the Brake and Clutch Bands, the Flywheel, Magneto Magnets, Coils and Field Plate.

- | | |
|---------------------------|------------------------|
| 1—Transmission Case Base. | 8—Reverse Drum Band. |
| 2—Clutch Spring Support. | 9—Triple Gear. |
| 3—Clutch Spring. | 10—Flywheel. |
| 4—Clutch Shift or Collar. | 11—Magnets. |
| 5—Clutch Finger. | 12—Field Coll. |
| 6—Brake Drum Band. | 13—Transmission Shaft. |
| 7—Slow Speed Drum Band. | |



Cover of the Ford Transmission Case and the Control Mechanism.

- | | |
|-----------------------------------|------------------------------------|
| 1—Magneto Contact. | 11—Service Brake Pedal. |
| 2—Brake Pedal Shaft. | 12—Reverse Pedal. |
| 3—Slow Speed Shaft. | 13—Transmission Springs. |
| 4—Reverse Pedal Shaft. | 14—Reverse Pedal Shaft Support. |
| 5—Clutch Lever. | 15—Slow Speed Pedal Shaft Support. |
| 6—Clutch Lever Adjusting Screw. | 16—Brake Pedal Shaft Support. |
| 7—Slow Speed Connection. | 17—Clutch Lever Shaft. |
| 8—Slow Speed Connection Clevis. | 18—Clutch Release Fork. |
| 9—Slow Speed Connection Lock Nut. | 19—Reverse Adjusting Nut. |
| 10—Clutch Pedal. | 20—Brake Adjusting Nut. |

to the engine unit, there being two bolts in the crank case section and two in the transmission housing top. If the engine only is to be worked on the removal of the two bolts in the housing of the transmission will suffice, but if the power transmission system is to be gone over the four can be taken out. There is no gasket between the universal joint cap and the engine case.

Next the cover of the transmission housing, through which access is had to the bands of the transmission drums, is removed. This is secured by six cap screws and there is either a cork or a paper gasket under it, cork if the machine is comparatively new, and probably paper, attached by shellac, if the chassis has been overhauled. The gasket can be loosened by a putty knife and saved, for unless broken it may be used again.

The crank case can be drained of the oil by removing the plug in the base of the flywheel housing, although there will be some remaining in the three troughs in the base of the crank chamber. This cannot be all removed until after the engine block is taken off. This oil may be filtered and saved, but usually it is not worth the time that would be required to filter it.

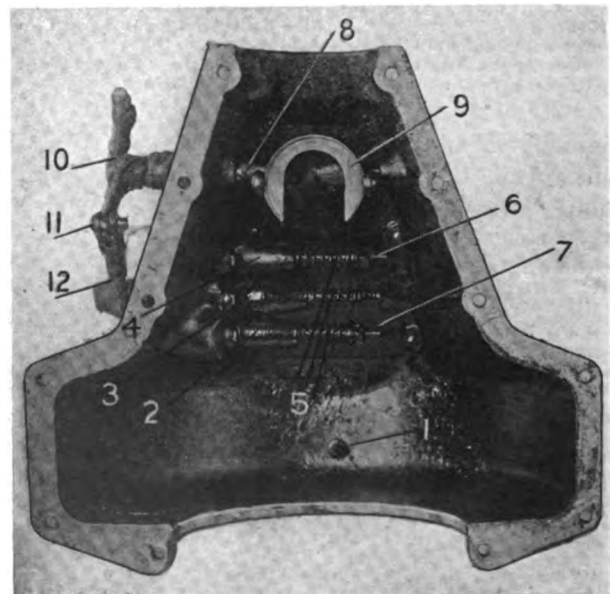
The transmission housing is secured to the engine case by 12 bolts, six on a side, and when these have been taken out the housing may be lifted, either with or without the cover. Between the flanges of the housing and the engine case are felt gaskets, which may have been put in with shellac or grease. They should be loosened carefully and saved for replacement.

When the housing is lifted the shafts of the brake, low speed and reverse pedals will be lifted

from the lugs of the bands about the drums of the transmission gearset and the bands will separate slightly and drop at either side. These bands should be marked with a file for identification for assembling, and a good plan is to number them one, two and three, regarding the forward or reverse band as No. 1. They can be marked without removing them from the case.

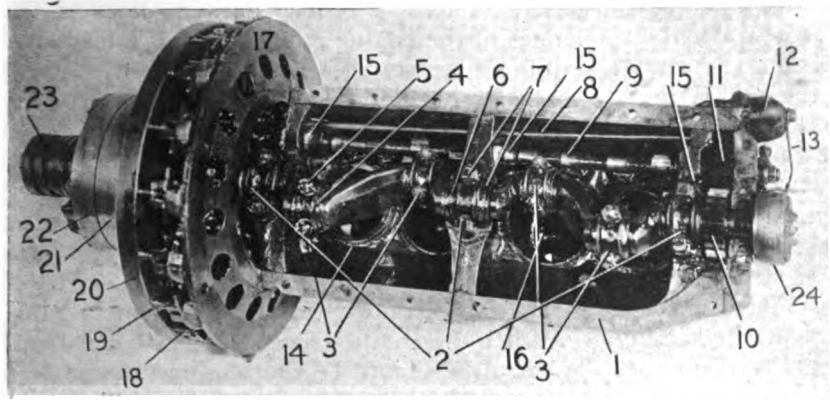
The engine block is secured to the crank case by 14 bolts, seven at either side, and when these have been taken out the cylinder unit and the transmission gearset assembly is ready for removal. If the car is equipped with a starter all of the connections ought to be freed. There are so many types and makes of starters that description of the needs for freeing the engine is impossible, but care should be taken to have the front of the chassis clear, for the engine block must be taken out over the forward member of the frame. In some instances the shaft of the starting crank must be drawn forward and secured so that it will not engage with the forward extension of the crankshaft.

When three men are available a section of iron pipe, a piece of stout timber such as 2x3 scantling, from eight to 10 feet length, and a half-inch rope perhaps 10 feet long can be used advantageously. The rope is passed through the cylinder block between the second and third cylinders and brought over the top of the casting and tied securely. Care should be taken to make a knot that will not slip. There is a section of thin steel



Inside of the Cover of the Ford Transmission Case and Its Auxiliaries.

- | | |
|--------------------------------|----------------------------------|
| 1—Magneto Contact. | 7—Reverse Band Adjusting Nut. |
| 2—Reverse Pedal Shaft Support. | 8—Clutch Lever Shaft. |
| 3—Slow Pedal Shaft Support. | 9—Clutch Release Fork. |
| 4—Brake Pedal Shaft Support. | 10—Clutch Release Lever. |
| 5—Band Disengaging Springs. | 11—Slow Speed Connection Clevis. |
| 6—Brake Band Adjusting Nut. | 12—Slow Speed Connection. |



Looking Into the Base of the Ford Cylinder Block Assembly.

- | | |
|-----------------------------|-------------------------|
| 1—Cylinder Block Flange. | 13—Timer Case Clamp. |
| 2—Main Bearings. | 14—Piston. |
| 3—Connecting Rod Bearings. | 15—Camshaft Bearings. |
| 4—Connecting Rod Cap. | 16—Wristpin. |
| 5—Connecting Rod Cap Bolts. | 17—Magneto Field. |
| 6—Main Bearing Caps. | 18—Magneto Field Colls. |
| 7—Main Bearing Cap Bolts. | 19—Magneto Magnets. |
| 8—Oil Tube. | 20—Flywheel. |
| 9—Camshaft. | 21—Slow Speed Drum. |
| 10—Crankshaft Timing Gear. | 22—Brake Drum. |
| 11—Camshaft Timing Gear. | 23—Clutch Spring. |
| 12—Breather or Filler. | 24—Engine Starter Drum. |

metal screwed to the dash that fits the top of the cylinder block. This should be taken off to avoid bending it from contact with the casting as it is lifted. With the dash cleared the timber is placed through the loop of rope and with a man at either side of the chassis, the third man at the forward end to steady it, the unit can be lifted above the engine case and the frame and carried wherever desired.

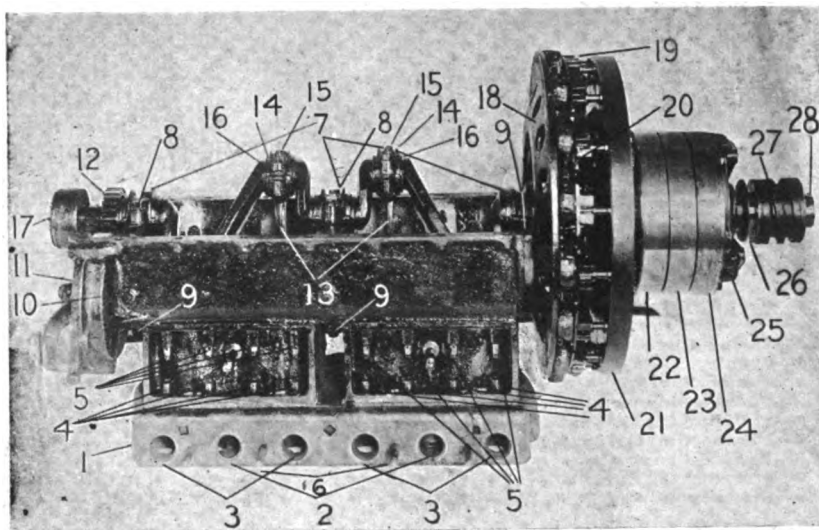
With two men the engine can be taken out quite as easily, but more care is necessary. A piece of rope about 10 feet long is required. As the footboard has been taken out, man should stand with a foot on either side of the body frame behind the dash and where he will be almost directly above the rear end of the transmission gearset. The centre of the rope is wound twice around the clutch spring with the ends free. The second man stands in front of the frame facing the engine. By grasping the edges of the flange as the rear end of the block is raised by the rope, which can be done without danger of jamming one's fingers, the second man lifts the front end and the casting is carried forward until the end rests upon the frame cross member.

Then the rear end is lowered until it rests in the bottom of the engine case. The man handling the rope next passes the ends under the dash and goes from behind to the front of the

dash, and standing with one foot on either side of the car frame with the rope, the rear end is lifted as before, and with the second man the casting is swung forward until the flywheel is in front of the frame member. The unit is lowered until the drums of the transmission rest on the frame, and it is held in this position until the man on the car frame can step to the floor, wind the rope several times about the clutch spring and collar, which will afford him a secure grip, when the block can be carried and placed on the barrel or bench and turned so that the crankshaft is uppermost. The reason for this manner of placing is that there shall be no strain on the magneto field by it being brought in contact with the bench or barrel.

The manner of two men handling the engine block has been detailed so that there shall be full understanding by the reader, because the assembly must be securely held after the forward end has been lifted out of the chassis. The work can be easily and quickly done and without risk of the unit falling.

After the first forward lift of the engine block in the base the bands of the transmission gearset

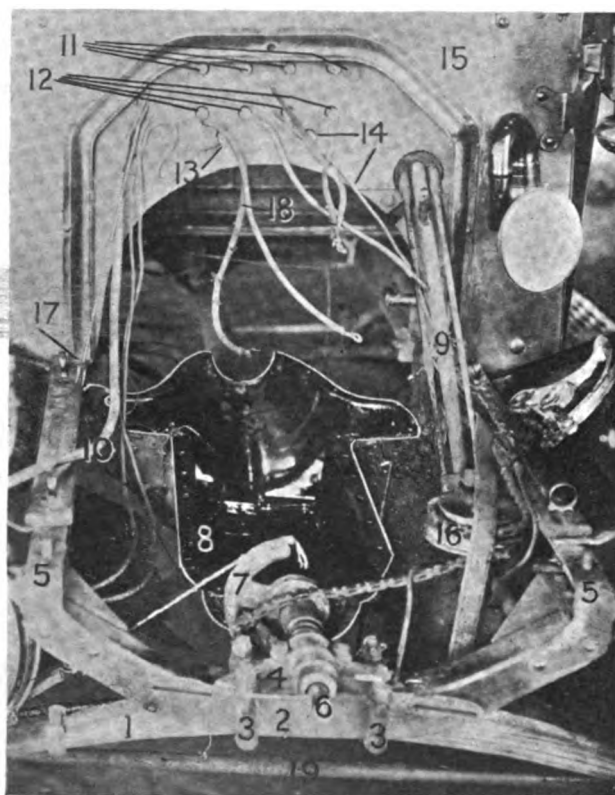


The Ford Engine and Transmission After Removal and Before Dismantling.

- | | |
|----------------------------|------------------------------|
| 1—Cylinder Block. | 15—Connecting Rod Cap Bolts. |
| 2—Intake Ports. | 16—Connecting Rod Bearings. |
| 3—Exhaust Ports. | 17—Engine Starter Drum. |
| 4—Valve Guides. | 18—Magneto Field. |
| 5—Tappet Guides. | 19—Magneto Field Colls. |
| 6—Manifold Stirrup Studs. | 20—Magneto Magnets. |
| 7—Main Bearings. | 21—Flywheel. |
| 8—Main Bearing Bolts. | 22—Reverse Drum. |
| 9—Main Bearing Bolt Nuts. | 23—Slow Speed Drum. |
| 10—Timing Gear Case. | 24—Brake Drum. |
| 11—Timing Gear Case Cover. | 25—Clutch Finger. |
| 12—Crankshaft Timing Gear. | 26—Clutch Shaft. |
| 13—Connecting Rods. | 27—Clutch Spring. |
| 14—Connecting Rod Caps. | 28—Transmission Shaft. |

can be slipped off the drums backward and, being marked for identification, no further attention need be given them until late. Should the bands separate sufficiently to drop off the drums they will be in the engine case.

With the cylinder block out of the chassis the interior of the crank case and flywheel and transmission housing base can be cleaned by wiping and flushing with kerosene or gasoline. The oil cocks in the flywheel housing can be taken out and soaked in gasoline and disassembled if they are found to be partly or wholly obstructed. The cocks ought to be perfectly free, so they can be depended upon, and there is possibility of particles worn from the fabric of the transmission bands being carried into them. They can be tried



The Engine Base and Auxiliaries Remaining in Chassis.

- | | |
|-----------------------------------|-------------------------------|
| 1—Front Spring. | 11—Primary Coil Terminal. |
| 2—Frame Front Member. | 12—Secondary Coil Terminals. |
| 3—Spring Clips. | 13—Coil Battery Terminal. |
| 4—Crank Case Front Frame Bearing. | 14—Coil Magneto Terminal. |
| 5—Chassis Side Members. | 15—Dash. |
| 6—Starting Crank Shaft. | 16—Starter Chain Drum. |
| 7—Engine Starter Sector. | 17—Carburetor Adjustment rod. |
| 8—Engine Crank Case. | 18—Secondary Wiring. |
| 9—Steering Column. | 19—Tie Rod. |
| 10—Primary Wiring Case. | |

with a wire and if not obstructed require no attention.

The section of the engine case remaining in the chassis can be examined to learn if the bolts securing the supporting arms to the chassis frame side members are solid and the bottom plate below the crank chamber can be taken off. As there is a gasket, usually of paper, applied with shellac, between the plate and the case, there is no reason to remove either, unless there is a leaky

gasket. There are felt gaskets between the flanges of the engine case and the cylinder block, and these are set with shellac as a rule. If these can be removed without tearing they may be used again. Here may be stated that unless one is absolutely certain of the condition of the gaskets that are taken out they had best be replaced with new. The cost is so trifling for an entire set for a chassis that one saves nothing in taking chances and may have considerable work to repeat for the endeavor to economize ridiculously small sums.

When the engine block is on the bench, frame or barrel, it should be thoroughly cleaned of oil and grease, and this can be done with waste or rags, and finally wiping with cloths wet with gasoline. The job should be done at one time, for working with parts covered with lubricant is not pleasant.

After cleaning the condition of the main bearings can be learned by lifting the transmission gearset and flywheel to determine the play, the state of the connecting rod bearings can be found by lifting the rods, and the same test can be made of the wristpins. There should be no confusion of the requirements of the bearings. There should be no end play of the crankshaft in the main bearings, and if there is end and side play the journals are considerably worn. There should be no side play for either the crankpins or wristpins of the connecting rods, but there must be some end play so that the bearings may adapt themselves to the shaft and pins.

The connecting rod and wristpin bearings ought logically to wear more quickly than the crankshaft bearings. With reference to the definition of the term worn as applied to bearings, this means that the internal diameter of the bearing is larger than the diameter of the shaft or pin. A perfect main bearing will not allow either side or end play, but there must be some end play of the connecting rod or wristpin bearing, but no side play. This can be ascertained by observation of new bearings of these types.

(To Be Continued.)

WOULD LOWER GAS PRICE.

The Springfield, Mass., Automobile club has inaugurated a movement for national control of oil wells and prohibition of the shipment of gasoline to other countries in order to hold down the price to the domestic consumer. Thomas L. Hisgen, former Independent party candidate for the presidency of the United States, and once president of the Independent Petroleum Marketers' association, is prominent in the movement. A recent statement by Secretary Lane of the Interior Department, indicating that the present high price of gasoline is due largely to monopolistic control of the crude oil output by the large oil companies, is the basis of the movement.

PRACTICAL FACTS FOR NEW CAR OWNERS.

Elementary Instructions in the Economical Operation, Maintenance, Adjustment and Repair of the Ignition System---Answers to Inquiries from Subscribers.

THE discussion of the magneto now leads to the fully constructed type. The principles upon which the magneto is built have been explained in previous articles, and if the reader will retain these principles in mind he will not experience much trouble in understanding the fully constructed magneto. Fig. 1 shows two views of a magneto of this type, which is designed to supply current for a four-cylinder motor. The first view shows the circuit breaker, often termed a contact maker or timer, and a distributor. The breaker consists of a cam, a cam lever and contact points. This cam is secured to and driven by the inductor shaft. At certain intervals of each revolution it causes the contact points, which touch under normal conditions, to separate. This separation takes place twice during each full revolution of the inductor shaft. The function of the distributor is to collect the current of high potential, which is obtained from the transformer coil, and at the proper time to supply it to the individual spark plugs.

The Magneto Distributor.

The distributor is usually made of hard rubber and is attached to the frame of the magneto. There is a round opening in the centre, and the various wires leading to the spark plugs are inserted in this. The distributor segment is mounted on a revolving disc of hard rubber, which passes close to the wires leading to the spark plugs, but does not touch them. This disc is secured to the end of the distributor shaft, which in turn is geared to the inductor drive shaft.

The magneto shown furnishes current for a spark at each half revolution of the inductors. This is accomplished by the gearing between the main and distributor shafts being in such relationship that the distributor shaft makes one revolution for every two of the inductor shaft.

The usual method of wiring this type of magneto is shown in Fig. 2. This being a magneto of the low-tension type, it is necessary that an induction coil be used to build up the current to a poten-

the points if the effect was not minimized by the condenser forming part of the coil and absorbing all surplus current. The condenser consists of several layers of tinfoil, each lay-

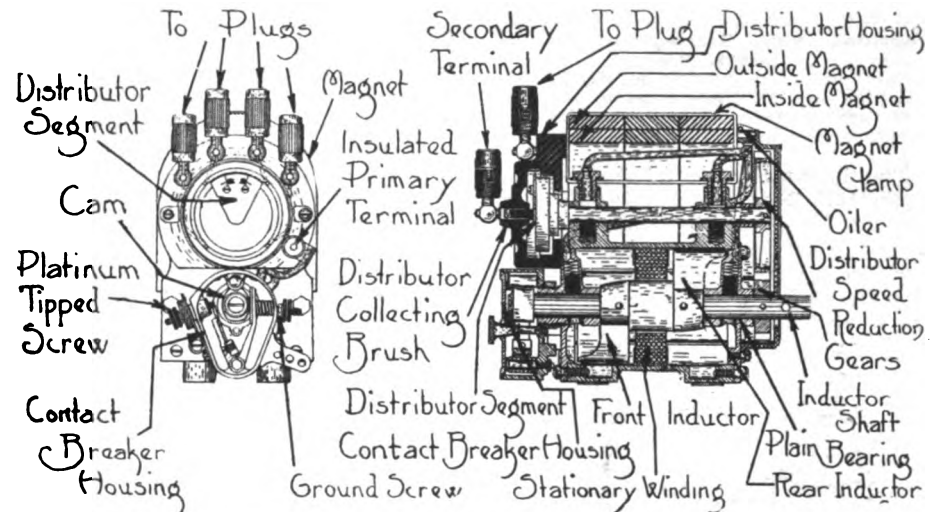


Fig. 1—Showing Circuit Breaker and Distributor and View of the Working Mechanism of a Magneto Designed for a Four-Cylinder Motor.

tial high enough to leap the air gap in the plugs.

The induction coil consists of an iron core surrounded by two windings. The first winding is termed the primary and consists of a few hundred turns of coarse wire, being directly wound upon the core. The other, which is called the secondary, is wound over the primary and consists of several thousand windings of fine conductor.

Induction of High Potential.

The low-tension current, regardless of whether it be taken from the magneto or the battery, is first received in the coil through the coarse windings. When it is interrupted, high potentiality is instantly induced in the secondary winding because of the great suddenness with which the magnetism leaves the soft iron core. The interruption is brought about by the cam in the breaker, it separating the contact points.

As the contact points are separated, the current still tends to flow and a brilliant spark is visible between them. The resulting heat would soon burn away the platinum from

er being separated from the other by insulation, and the alternate sheets being connected to the same terminal.

The next step in the discussion is the consideration of the relationship of the parts to each other. On the face of the coil box is a switch and it is here that the flow of current is controlled. This switch may be turned in any one of three positions, battery, neutral and magneto. When turned to magneto the current produced in the stationary winding in the magneto flows through the primary winding of the induction coil. When this flow is interrupted by the separation of the contact points in the breaker, the stoppage will cause a current of high potential to be induced in the secondary winding. This current is then carried to the magneto distributor and from here it is distributed by the segment, which is accurately timed to contact with the brush that delivers the current to that plug which is ready to fire. If the switch be placed in battery position, the same procedure takes place except that the source of current is a chemical producer instead of a mechanical generator.

Starting the Motor.

If the engine is spun vigorously while the spark is slightly advanced, the magneto will supply current for starting. This operation, however, can be made much easier, especially in cold weather, if a separate battery be used for this purpose. In many cars having motors of four or more cylinders, starting may frequently be effected without the use of the hand crank. To do this it is imperative that compression be retained in the

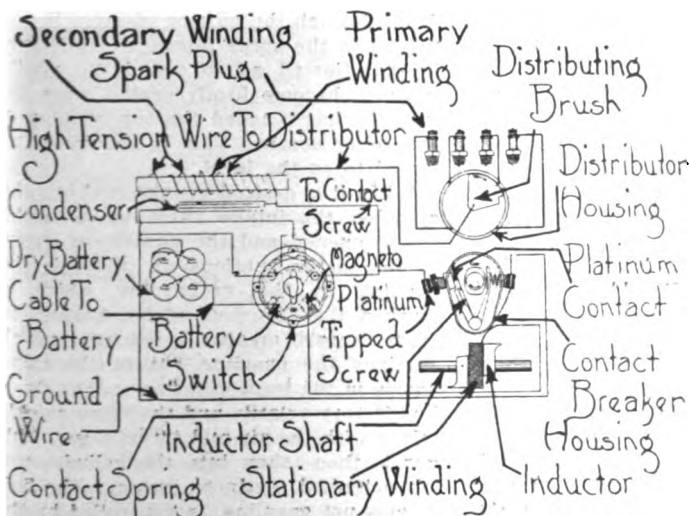


Fig. 2—Diagram of Usual Wiring System of a Low-Tension Magneto Designed for a Four-Cylinder Motor.

cylinders and that a spark be made to occur in that cylinder which is about to fire. To obtain this spark independently of the timer, which only operates when the inductor shaft turns, a push button is provided on the switch. With the switch turned to battery a push of the button the passage is interrupted in the the primary winding. By releasing the button the passage is interrupted in the same manner as though the points of the timer were separated by the cam.

READERS' QUERIES.

Adjusting Main Bearings—G. C., Plymouth, Mass.

Can you tell me how to adjust the main bearings on a 1912 Reo touring car?

If you have room will you insert a sketch of the bearing construction?

The three main or crankshaft bearings in the 1912 Reo four-cylinder touring car can best be adjusted by removing the underpan from the chassis frame and the hand hole plates from the crank case. The first operation is to remove the locking wires from the heads of the locking bolts and with the socket wrench, which

The arrangement not only securely locks the starter, but the transmission and front floor board as well. By fully depressing the push rod, which is shown at the extreme upper left in the rough sketch herewith, the electric starter is placed in operation. In the Reo car, two rods project forward from the transmission case, and to make a gear change, one of these rods must move either backward or forward, depending, of course, on which gears are being changed. Near the ends of these rods is a slot, into which fits the steel rod which controls the starter. By depressing the plunger about half way the steel rod is inserted between the two rods and locks them so that they cannot be moved. The plunger is encased in a housing, and as can be seen in the illustration, provision is made for inserting a pad lock. When this lock is set in the position shown, it is impossible to operate the electric starter, engage any gear in the transmission or raise the floorboard.

Methods of Using Wrenches—J. K. F., Falmouth, Mass.

Being an old subscriber to The Automobile Journal, I would like to ask if an ar-

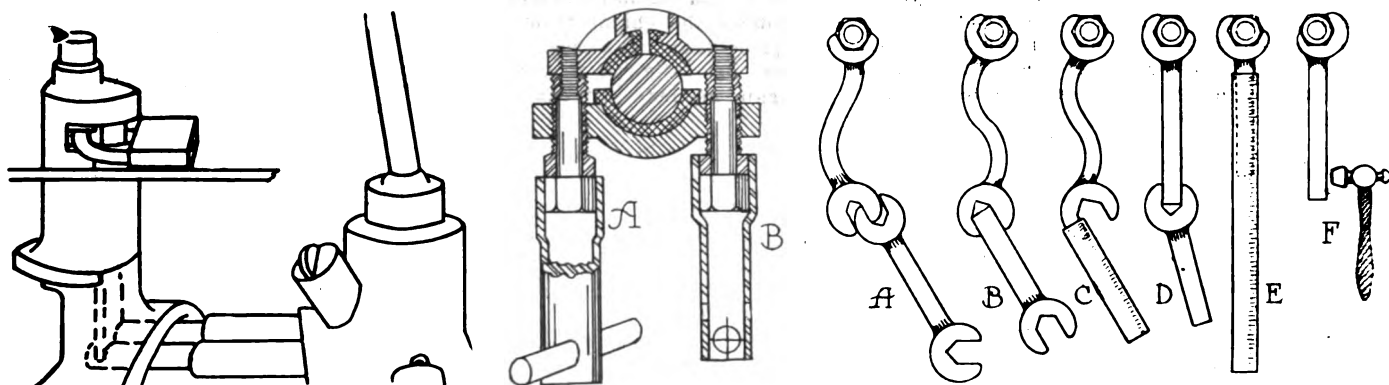
handle by placing a long length of piping over it.

If a nut has become firmly set it may resist removal regardless of the increased leverage. A method which generally proves effective in such cases is shown at F. The wrench is firmly set on the nut and then a series of sharp blows struck on the handle with a hammer.

Principle of Carburetion—F. G., Baltimore, Md.

Will you explain in as plain words as possible, the working principle of a float type carburetor?

The accompanying illustration shows a simple type of float carburetor. The gasoline flows from the main storage tank through a piping of small diameter and enters the carburetor through the opening marked A. As the fluid contacts with the metal or cork float, as the case may be, it causes the float to rise. The float in turn causes the ends of the toggle levers, which rest on its top surface, to also rise. These levers are pivoted and therefore if the outer ends of the levers rise, the inner ends of the levers must



Locking Arrangement Used in 1916 Reo Cars Which Securely Locks Floorboard, Starter and Transmission; (At Left) Method of Adjusting Main Bearings in Reo Car (at Centre); Illustrating Six Methods of Obtaining Greater Leverage on Set Wrenches.

forms part of the regular equipment of the car, unlock the two bolts by placing the wrench over the head of the lower, as shown at A, and turning to the left. The wrench can then be pushed over the head of the threaded spacing sleeve and, by turning, the bearing caps may be moved closer together or further apart as the case may require. The method of adjusting the bearing is illustrated at B.

If the bearing requires only slight adjustment, turn the spacing sleeves about a half turn to the left and then, after lowering the socket wrench to the locking bolts, turn to the right. After an adjustment has been made to each bearing, it should be tested by opening the relief cocks on the cylinder heads and turning the motor over slowly by hand. If it turns stiffly, the bearing is too closely adjusted. Care should also be taken to ascertain that equal adjustment is made on both sides of a bearing and that the locking wire is replaced when the final adjustment has been made.

Lock Used on 1916 Reo Cars—D. H. S., Milford, Conn.

Will you describe in an early issue, the features of the locking arrangement used in the 1916 six-cylinder Reo touring car? Does this arrangement lock the starter?

article which was published about a year ago relative to the different methods of using a set wrench can be found and republished? If I remember correctly a sketch was also published illustrating the methods.

An article relative to the different methods of using a set wrench appeared several years ago. The sketch used in connection with the article is shown herewith. The object in view is to afford a greater leverage than is possible by gripping the end of a single wrench with the hand. At A is shown a wrench having two openings and fitted to a nut. Greater leverage is obtained by using another set wrench and connecting the ends in the manner shown. Another method is shown at B. The additional leverage is obtained by inserting the handle of a wrench having a single opening into the opening of a second wrench. At C the leverage is produced by placing a piece of piping over a lip of the disengaged opening of the tool.

When a nut is gripped by a wrench having only a single opening, a greater leverage can be obtained by gripping the end of the handle in the opening of a second wrench as illustrated at D. At E is shown the method of lengthening the

lower. The inner ends of the levers are in connection with the needle valve and when the float has raised to a sufficient height the levers firmly seat the needle valve, thereby shutting off the supply of gasoline from the main tank.

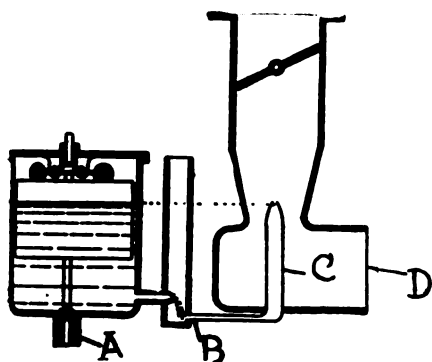
From the float chamber the gasoline flows through the narrow channel B, and thence to the spray nozzle C. The float is so adjusted as to cause the needle valve to become firmly seated when the gasoline has reached the top opening of the spray nozzle. This is commonly referred to as the level.

When it is desired to take fuel into the cylinder, the intake valve in the cylinder is opened and the downward stroke of the piston suctions air through the opening in the carburetor which is marked D. The rush of air around the spray nozzle creates a vacuum which suctions the gasoline out of the spray nozzle in the form of a fine spray. Gasoline is very volatile and therefore quickly mixes with the air and forms a gas. This gas is then taken into the cylinder and when ignited produces power. The flow of gas, not gasoline, is controlled by the opening and closing of the butterfly valve, which is shown in the upper part of the mixing chamber. The throttle

lever, which is manipulated by the driver, operates the butterfly valve.

New Wrist Pin Construction—T. C. M., South Boston, Mass.

Do you think that a piston pin connec-



Illustrating the Principle by Which Gasoline Is Transformed to Vapor.

tion made like a universal joint would be of any advantage to an automobile engine?

Some of my friends think so, others do not see the necessity for the improvement. I would like your unbiased opinion. Enclosed is a sketch of the idea.

It does not seem that any advantage is obtained by the use of this device instead of the conventional type of wrist pin. The first point to be considered is weight. If the arrangement shown was to be adopted, it would be necessary to use a piston of special construction which would have to be strengthened to permit the boring of four holes on a line. It is not clear how you intend to insert the pins into their bosses. In the sketch it does not appear as if the short pins could be removed. If this is true, how do you intend to insert the pins into their special bosses? Granting, however, that you have made provision for inserting all the pins, the use of this device does not insure perfect alignment of the piston. If the piston was forced out of alignment, as shown at B in the accompanying illustration, this arrangement would not perfect the alignment. It is also not clear what is meant by a working fit. If it is meant that play is to be allowed, the idea will not prove practical. If play was allowed in the wrist pin, there would be a distinct pounding sound at each stroke of the piston. With the present construction, if three or more rings are used on the pistons, there can be no maladjustment unless some part is much strained.

Formula—Anon., Attleboro, Mass.

What is the formula used in figuring the number of gallons of gasoline in a tank which is 24 feet long and four feet wide?

How is piston displacement figured?

The formula for finding the capacity of a tank is to square the diameter and multiply the result by the constant .7854. The product now obtained should be multiplied by the length.

The American gallon occupies space equivalent to 231 cubic inches. The following is therefore the procedure by which to determine the number of gallons in a tank which is four feet wide and 24 feet long. Change the dimensions into inches.

$$48 \times 48 \times .7854 \times 288 \div 231 = 2256 + \text{gallons.}$$

The formula for finding the piston displacement is the same as used to find the capacity of a cylindrical tank. The formula is as follows:

Square the bore x the stroke x .7854 x number of cylinders.

If a four-cylinder motor had a bore of four inches and stroke of five, the piston displacement would be found as follows: The square of four inches is 16. When this product is multiplied by the constant .7854 the result is 12.5664. Next multiply this 12.5664 by the stroke, which is five inches, and the result is 62.832 cubic inches. When 62.832 cubic inches is multiplied by four, which is the number of cylinders, the final result is 251.328 cubic inches, the piston displacement.

Care of Non-Skid Chains—F. K. L., Troy, N. Y.

Is it necessary to afford any care to non-skid chains other than to remove them from the wheels and allow to dry at the end of a run?

Carelessness in small things combine to help produce an enormous cost of upkeep for the machine. Proper care of the anti-skid chains affords an opportunity for the motorist to reduce this total. The average driver after a run in the mud and slush, will remove the chains from the wheels and place them in a heap in a corner. They are allowed to remain there until again needed. Although the handling of chains is a disagreeable task, the life of this equipment is dependent upon the care given. It is impossible to give any one rule to follow because there are many in vogue which give equally good results.

One motorist who boasts of being an economical operator of a machine writes that he always removes the chains from the wheels after a run in the mud or slush. They are hung on a hook and washed by applying a gentle stream of water from the hose used for washing the car. This removes all grit, mud, etc., from the links. For a period of about 15 minutes the water is allowed to drip from the chains, after which they are rubbed with a dry cloth. He next plunges them into a kerosene bath and then allows them to dry in the same manner as when

washed with the water. As a last precaution against rust, they are rubbed with a cloth which is saturated with a mixture of kerosene and light lubricating oil. When these precautions are followed chains will give satisfactory service for the entire season.

Gasoline Substitutes—G. C., Trenton, N. J.

Can kerosene be mixed with gasoline as a fuel for gasoline engines?

Can the motor be operated on kerosene alone?

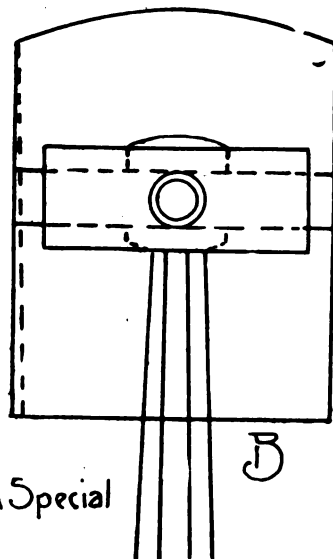
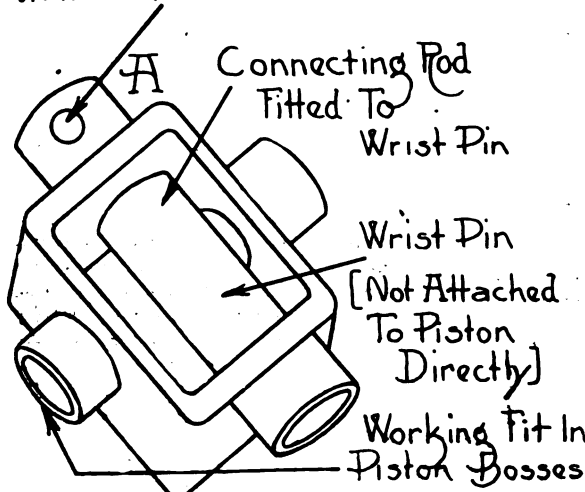
Is there any truth in the statement commonly circulated that a new substitute for gasoline has been discovered?

The manufacturers of gasoline engines as now used generally designed them so that they should be operated by gasoline as a fuel. It is, therefore only reasonable to believe that if any other fuel is used the full efficiency of the motor cannot be produced. Because of the high cost of gasoline many drivers are using a mixture of gasoline and kerosene. The disadvantages of the use of this combination are rapid carbonization in the cylinders, hard starting and unequal vaporization points. It does not seem that the slight pecuniary saving afforded by combining the two liquids would warrant the use of the mixture.

The gasoline engine is not equipped with a carburetor designed to utilize kerosene. A cold motor could not be started with it because of its high vaporizing point. There have been instances, however, when a motorist has run short of gasoline and has used kerosene as a fuel to propel the vehicle to the nearest filling station. In such cases the motor was warm enough to produce sufficient heat to vaporize the kerosene.

There has been no authentic announcement that a new substitute has been discovered to replace gasoline as a fuel. There have been many experiments with new fuels, but their indifferent success has not warranted their adoption. A late rumor has it that an experimenter in Germany has discovered a new alcohol for motors which has a specific gravity of from 90 to 95 per cent. It is claimed that by mixing this fluid with either benzol or gasoline a good fuel is produced.

Wrist Pin Held In Position Here



Proposed New Wrist Pin Construction—Fig. B, Showing Misalignment of the Piston Which Would Not Be Corrected by Use of Device.

HAPPENINGS AND COMMENT IN THE INDUSTRY.

THE Hupp Motor Corporation, Detroit, Mich., announces through Lee Anderson, commercial manager, that for the seven months from July to February its business averaged 67 per cent. greater than in the same months of the previous year. For January the sales were 62 per cent. larger. Orders on the books Feb. 1 were 208 per cent. more than for the corresponding month of 1915.

The Willys-Overland Company, Toledo, established bowling alleys for its employees in the centre of the plant some time ago. They are open from 4:30 to 7:30 on working days, during which time the men are allowed to practise. As a result there has sprung up the Overland bowling team, which won the Ohio state championship last year. Each department is represented by at least one team, and after 7:30 in the evening they compete. The individual scores are carefully kept and the best bowlers are picked out to form the teams that will represent the

Chalmers company at the Chicago show, following the decision of the Agricultural Credit Company, one of the biggest in the country, to buy \$5,000,000 worth of customers' notes from Chalmers dealers. The rate of interest charged for the accommodation is only six per cent. and only a small deposit is required as the initial payment before a car can be taken home by a purchaser.

The Marathon Tire and Rubber Company has taken over the business of the Akron-Marathon Rubber Company, Omaha, Neb., to provide needed enlargement of its business in the middle west. The management and selling force has been increased. H. H. Reynolds is division manager for the middle west, with headquarters at Omaha.

The Ahlberg Bearing Company announces the opening of a branch at 323 Peachtree street, Atlanta, Ga., and that, according to W. C. Bender, sales manager, the southeastern territory will be

been made public. The officers are C. J. Bour, Chicago, president; C. F. Stewart, Chicago, vice president in charge of sales; A. A. Gloetzner, Detroit, vice president in charge of purchasing and production; W. J. Brown, Detroit, secretary and treasurer; R. C. Davis, Oak Park, Ill., operating director. These officers and J. E. Noye, Chicago, comprise the board of directors.

The Chevrolet Motor Company of St. Louis is said to have received an order from the Chevrolet Motor Company of Delaware, a distinct corporation, for 200,000 car bodies. It was also declared that the company will build a \$100,000 addition to its plant and increase its regular output from 25 to 75 cars a day. The value of the body order is understood to be approximately \$4,000,000.

The Chevrolet Motor Company of Michigan is to begin at once upon the construction of a large addition to the Flint plant in which axles for all Chevrolet 490 cars are to be made in the future. The motors will be built in the Mason plant at Flint. In addition to the new axle plant plans have been made for the erection of an assembling factory in Flint. In the spring 150 first class homes will be built for the employees who will be engaged for the new enterprises.

The Packard Motor Car Company, Detroit, reports that 13,023 persons are working in its factory, a number of which have been added since the beginning of February. Simultaneously comes the announcement that during the first two weeks of this month the company's payroll totaled more than \$540,000, which is at the rate of about \$270,000 a week. The purchasing department is now buying material at the rate of \$2,500,000 monthly. The extensive building operations that have been going on at the Packard plant for some time are expected to be finished March 1. The floor space then will amount to about 54 acres and the plant will include 49 buildings on a factory site one mile long and 1000 feet deep.

The Pathfinder Company reports through W. E. Stalnaker, vice president and sales manager, that the plant is now running day and night to meet the demand made upon the company's production.

The Goodyear Tire and Rubber Company has made the first distribution of life insurance policies under its recently inaugurated group insurance plan. The total value was given as more than \$2,000,000. Each male employee who is a member of the Goodyear relief association and in good standing was given a policy for \$1000. Those given to female employees were valued at \$500.

The Hupp Motor Car Corporation, one of the extremely busy Detroit concerns, reports that it is turning out cars at spring and summer rates, but still cannot meet the demand. The banner day for the winter season was Feb. 17, when 101 finished Hupmobiles were turned out during the working hours of that day.



Interior of the Final Assembly Department of the Packard Motor Car Company, Detroit, a Recent Addition Made Necessary by Increase of Business—View Shows Glass and Steel Construction—Unit Assemblies Come in at the Left and Completed Trucks Pass Out for Final Road Test at the Right—Though Floor Space Devoted to Truck Manufacture Was Increased to Seven Acres, the Space Has Been Outgrown and a Tent Stands Outside and in It Final Adjustments Are Made—The Plant Is Working Day and Night.

factory in the state and national tournaments.

The Premier Cushion Spring Company has been organized in Detroit with W. D. McCullough as president and general manager; W. A. Falls, vice president and factory manager, and J. A. Schulte, secretary and treasurer. Cushion springs for automobile seats are produced, the first shipment having been made recently. The company's capacity at present is 1000 sets of springs a day, which will soon be increased.

The Chalmers Motor Company, Detroit, advises that Paul Smith, vice president of the Chalmers sales division, found that the sales conventions he attended recently in the South and Southwest were very inspiring to all concerned. He says: "Dealers were enthusiastic over the new Chalmers finance plan, which permits the sales of cars on time with only the banking rate of interest." The plan referred to is the one announced by the

in charge of H. A. Fisher. This is the eighth branch the company has established within the past nine years, the others being at New York City, Boston, Detroit, Cleveland, Minneapolis, Los Angeles and St. Louis. These branches provide the unusual service of supplying patrons with reground bearings of any type at about one-fifth of the price of a new set. A stock of new single row annular, thrust, new double row and Radax bearings is carried at each branch. The regrinding and manufacture of special bearings is done at the company's factories at Chicago and Los Angeles.

The Bour-Davis Motor Car Company, which was recently formed, recently purchased a large tract of land in Detroit, and it is understood that erection of a plant will be started at once. The price of the property is said to have been \$18,000, and that the factory will be one story high with a two-story office building. Details of the new car have not yet



Roadster

COMING!
The Only Car
Made in Boston.

See it at the Boston Show
Space 426

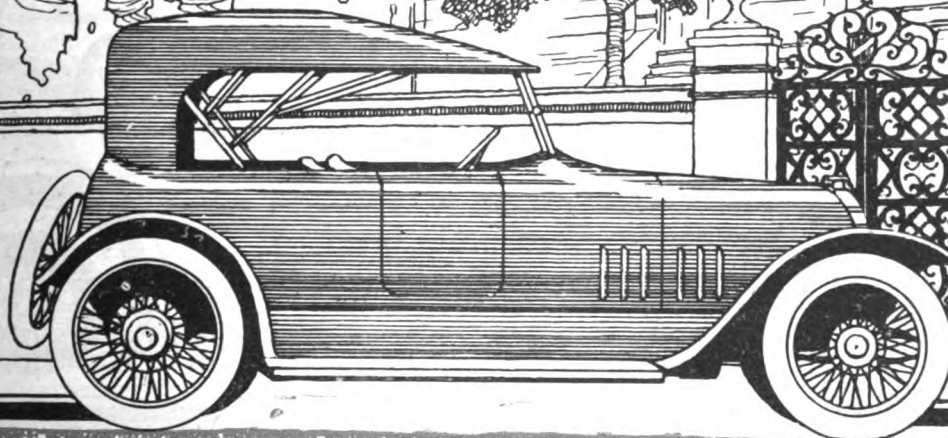
\$995 *f. o. b. Factory*

S J R MOTOR COMPANY

126 MASSACHUSETTS AVENUE

BOSTON, MASS.

(75-5)



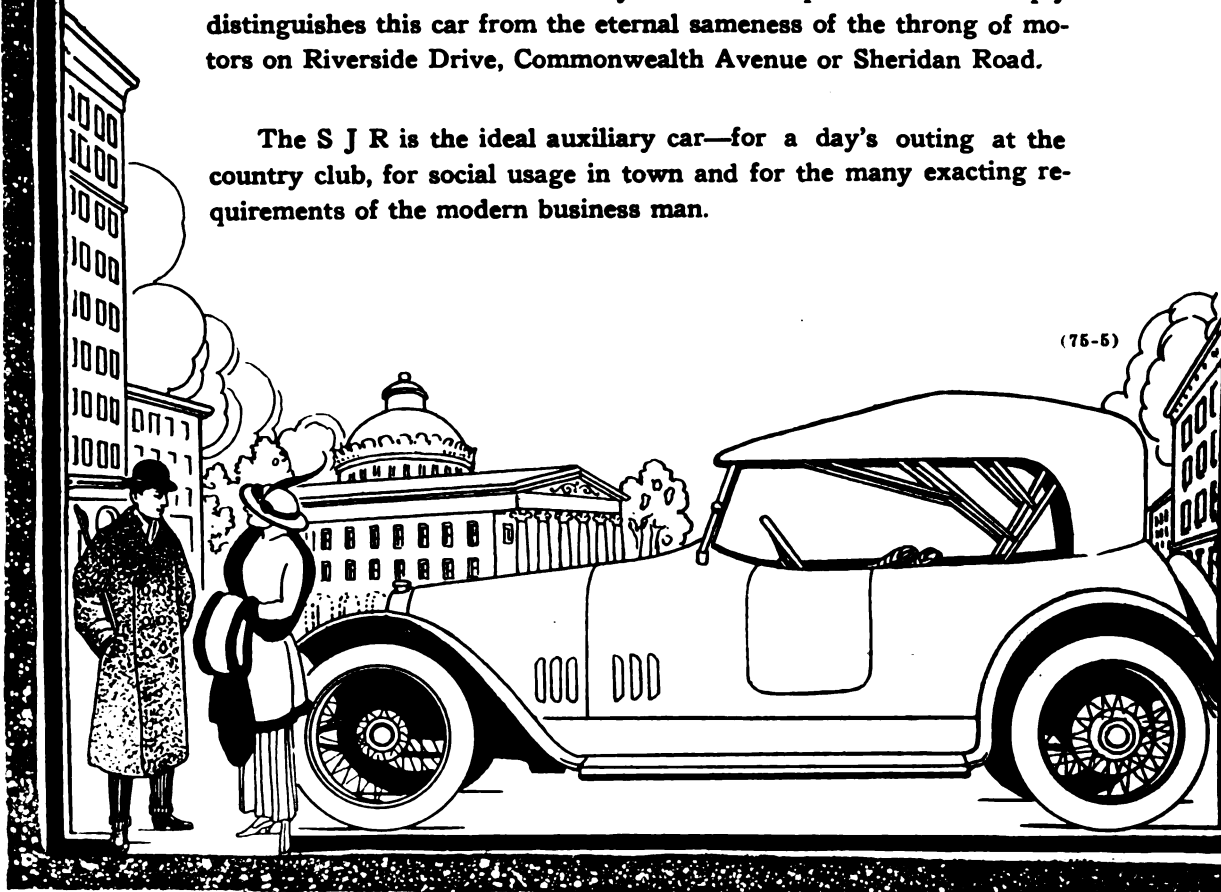


S J R Distinctiveness

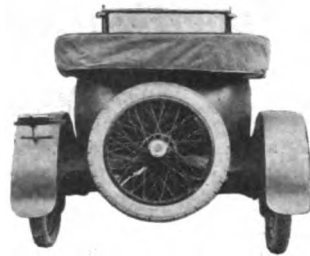
Europe has for several years produced cars of the general type of the S J R, but it has remained for our engineers to combine to the greatest extent the best features of European and American design in a car which stands absolutely unique in its field.

Individuality speaks from every line of the S J R. Its sweeping streamline curves running without a break from the jaunty radiator to the rounded rear end of the body create an impression that sharply distinguishes this car from the eternal sameness of the throng of motors on Riverside Drive, Commonwealth Avenue or Sheridan Road.

The S J R is the ideal auxiliary car—for a day's outing at the country club, for social usage in town and for the many exacting requirements of the modern business man.



(75-5)



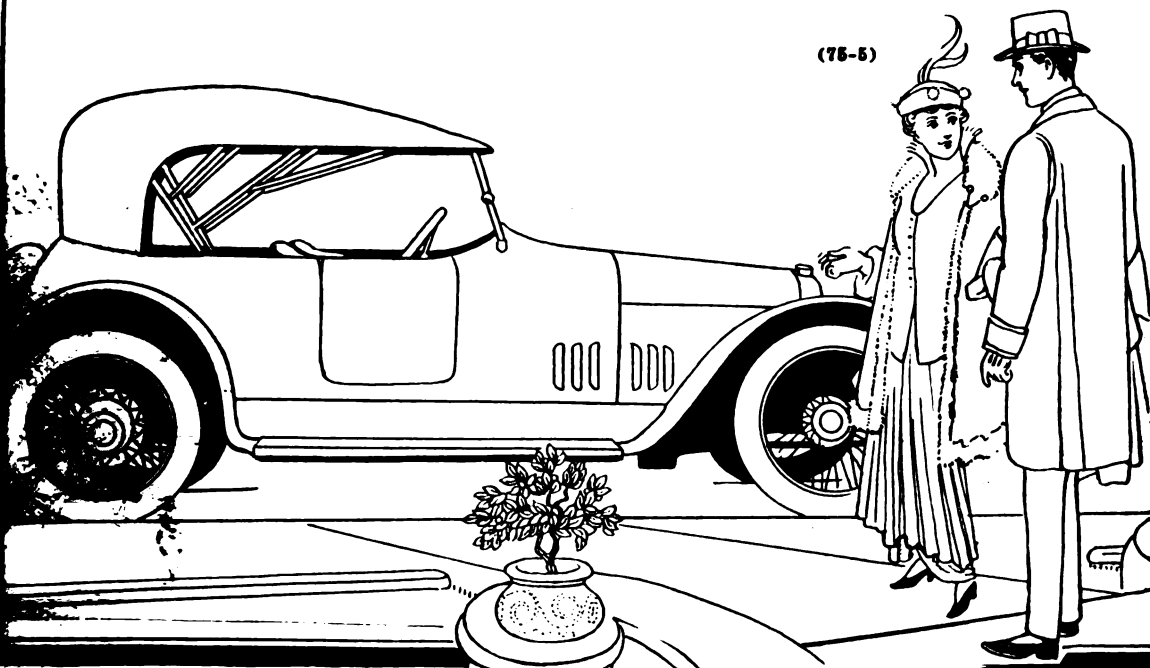
S J R Character

The ratio of horsepower to car weight is very high, insuring a responsiveness and quick "pickup" and "getaway" seldom found in any car regardless of size or price.

The small-bore, long-stroke, high-speed motor is marvellously compact and quiet, and delivers unusually high mileage per gallon of fuel.

The long, flat springs of chrome vanadium steel (cantilever type suspension on the rear) are so proportioned as to give exceptionally easy riding, even on country roads.

The pressed steel body is arranged to afford maximum comfort for three passengers. Entrance to the driving compartment is by a single door at the right side, and the divided front seat gives easy access to the deep-cushioned, luxuriously upholstered third seat in the rear.





Specifications:

Motor—25-30 hp., 3 1/4 in. bore, 4 1/2 in. stroke, 4-cylinder, cast enbloc with removable water-cooled head; large 2-bearing crankshaft of heat treated chrome nickel steel.

Transmission—Selective sliding gear, three forward speeds and reverse; triple heat treated high carbon steel gears; case bolted to flywheel housing; power plant a unit suspended at three points.

Clutch—Special disc type.

Lubrication—By camshaft-driven plunger pump and splash system; pump accessible at side of engine.

Ignition—High-tension water, oil and dust proof magneto.

Starting and Lighting—Six volt single unit system.

Carburetor—Automatic float feed special design that has high efficiency and great fuel economy at all speeds.

Cooling—Highly efficient thermo-syphon system with very large radiator.

Gasoline Supply—Fed by gravity from 13 gallon tank under cowl.

Control—Left side drive, control levers mounted on transmission case, gear shifting lever having positive lock for four positions, set spark, throttle lever on steering wheel.

Instrument Board—Natural wood, highly finished, instruments mounted flush, carrying Standard 60-mile speedometer with total and

trip dials, driven from transmission oil gauge, magneto and light switches, two ammeters, gasoline filler cap and gasoline indicator.

Wheelbase—110 in. Tread, 56 in.

Rear Axle—Full-floating, low carbon steel case, hardened steel differential gears and pinion and ring gear; ball bearings throughout.

Springs—Rear, cantilever type, 48 in. length; front, chrome vanadium steel, 42 in. length.

Steering Gear—Irreversible, worm and sector, 17-in. wheel.

Frame—High carbon steel; a design only in high priced cars.

Wheels—Houk wire wheels, standard QD rims; extra wheel and tire.

Tires—30x3 1/4 in.; plain tread front, non-skid rear.

Body—Three-passenger roadster, pressed steel, special dull finish, upholstery process leather, seats cushioned with natural curled hair.

Fenders—Handsome design pressed steel; linoleum covered aluminum bound running boards.

Windshield—Clear vision, rain vision, ventilating type, single piece French bevel plate glass.

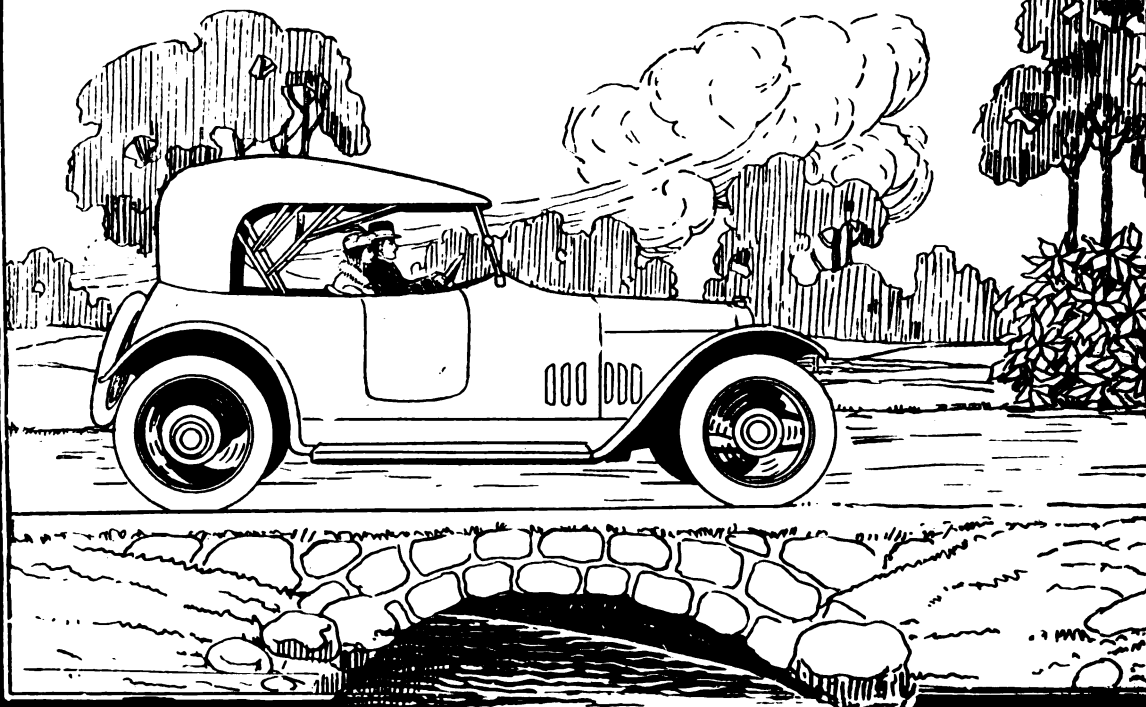
Top—One man type with dust envelope.

Lamps—Electric; two headlights with dimmers, tail and dash lamps.

Equipment—Vibrating horn, tool kit, tire repair outfit, wheel carrier, extra wheel and tire.

Price—\$995 f. o. b. factory.

(75-5)



NEW YORK

CHICAGO

BOSTON

DETROIT

Subscriptions:

The United States and Mexico,
\$1.50 a year; Canada, \$2.50 a
year. Other Foreign Coun-
tries in Postal Union,
\$3.50 a year.

William H. Black, Treasurer.

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THE AUTOMOBILE JOURNAL

Published the 10th and
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Ten cents a copy.

D. O. Black, Jr., Secretary.

Times Building, Pawtucket, R. I.

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VOL. XLI

FEB. 25, 1916.

NO. 2.

FOR SALE.

Shop Vulcanizer, Bargain.
Vanderpool, Springfield, O.

TIMES SQUARE AUTO CO.

WORLD'S LARGEST DEALERS

In Automobiles, Accessories and Supplies.
Selling Prices Lowest in the World. Send
for our Latest Price Wrecker and Save
Money.

TIMES SQUARE AUTO CO.

S. W. Cor. 56th St., 8'way 1210 Michigan Ave.
NEW YORK CHICAGO

**DEALERS, GARAGE MEN and
AUTOMOBILE AGENTS—**
To make money nowadays you
must buy cheap. We sell supplies
cheaper than any concern in the world.
Send for our latest bargain bulletin.

MECCA MFG. & SPECIALTY CO.

1743 Broadway 1208 Michigan Ave.
NEW YORK CHICAGO

MACHINERY

100 NEW VISES—\$1 per inch
width of jaw, all sizes 2½" to 5".
Send for circular. Lucas & Son,
Fox St., Bridgeport, Conn.

AGENTS WANTED

In every City and Town for Re-
pair Specialty of Value to Every
Owner. 100 per cent. profit. Send
for booklet. Eurich Mfg. Co.,
993 4th Ave., Brooklyn, N. Y.

SITUATION WANTED

Automobile Electrician, 24, first
class on starting and lighting
systems, electrical novelties on
cars, graduate of electrical
school, does a little drawing and
calculations, could get a chauff-
eur's license for testing above
systems, would like to hold a re-
sponsible position with manufac-
turing concern or high class re-
pair shop, in or around New York
state. Address Box 16, The Au-
tomobile Journal Pub. Co., Times
Bldg., Pawtucket, R. I.

Accessory and Garage Journal

A Distinct Trade Publication

25,000 Copies
Each Monthly Issue

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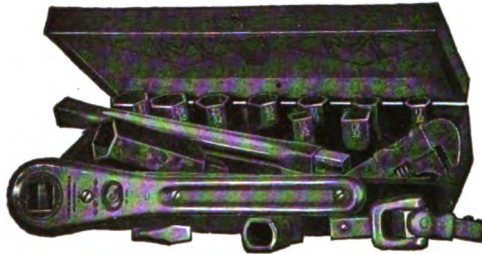
FORD

MOSSBERG

"SAFETY FIRST"

Work

Covers the adjustments on the FORD cars and its use assures you of safe passage of yourself and family



No. 15A set includes all wrenches necessary for FORD adjustments

TRUE

Guarantee



Is Never Called Upon

Ask for
Your copy of
Catalog
No. 171 A

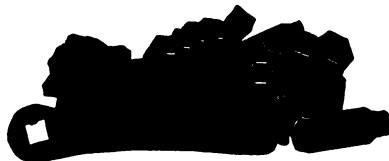
Socket Wrench Set for FORDS, No. 15 A

\$5.00

Your
Jobber Carries These

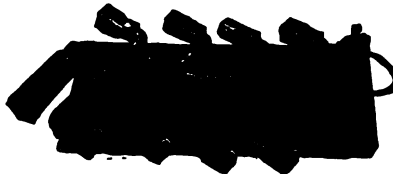
MOSSBERG Tools

If he doesn't, they will be shipped prepaid on receipt of price



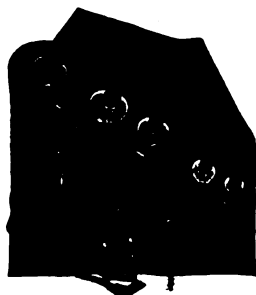
\$4.00

NO. 30 SOCKET SET



\$2.00

NO. 17 SOCKET SET



No. 10
FORD Engineer's
Wrenches
5 Wrenches
10 Openings

86c, \$1.⁰¹
\$1.²⁶

MOSSBERG Guaranteed Tools



No. 630
Special
"Allwork"
Wrench

26c

No. 645
Reverse
and
Brake
Pedal
Ratchet
Wrench

50c

For All Sorts of Work, MOSSBERG Tools Are Guaranteed



The most desirable type
of FORD Valve
Grinder

No. 605 **25c**



Drop Forged FORD Wrench
8 inches
long **25c**



FORD
Kit Wrench **12c**



The "Old Necessary"
Hub Cap Wrench **10c**

FRANK MOSSBERG CO.

ATTLEBORO, MASS.

BRANCH OFFICES:

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Seattle, Wash., 214 Maritime Bldg.
Dallas, Texas, Box 927.
Waynesville, N. C.



We Desire to Make Direct Selling Arrangements With New England Dealers on Our \$650 Car

We have greatly increased the production of our Light Four Model and right now the Production Department is turning out a big quantity of these cars. Heavy daily shipments are being made and orders are being filled promptly. These things mean a great deal to you.

Coincident with the increase of our production, we are expanding our Sales Organization and desire to make direct factory selling agreements with Dealers in large and small cities or towns throughout New England. With our mighty attractive schedule of prices and a premium for the man who can sell a certain quota, we offer a dealer a real money making proposition.

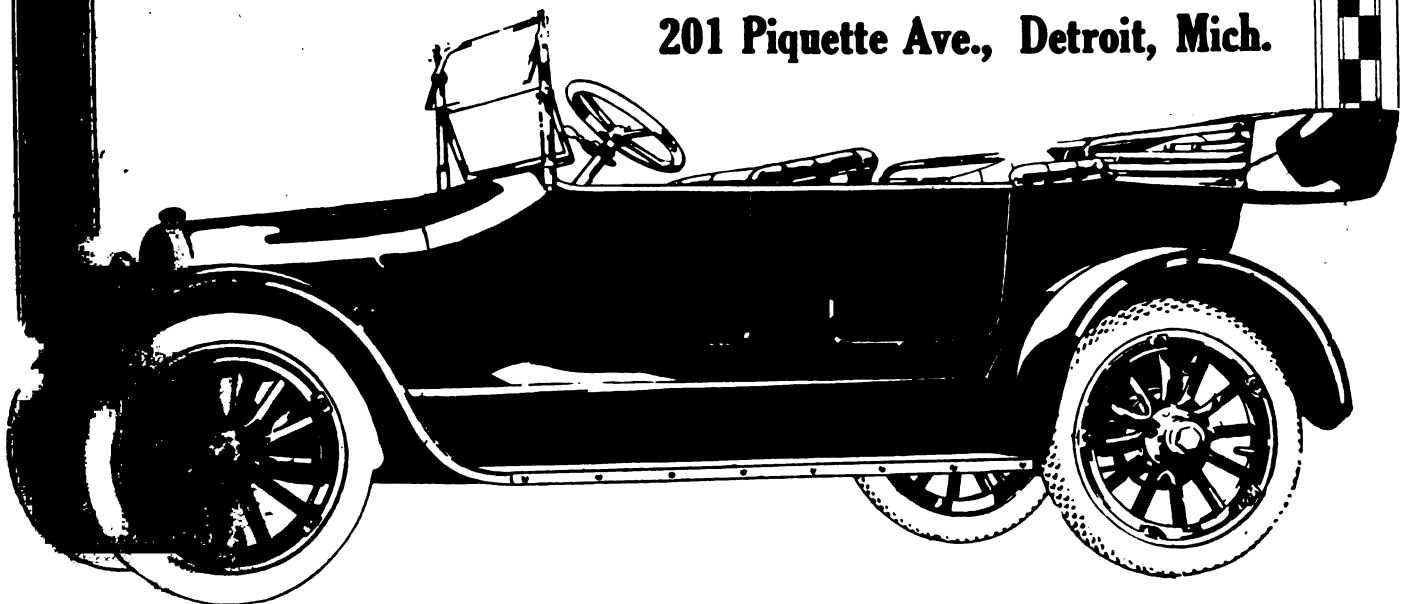
Think of these things—big production—big advertising campaign—direct deal with the factory—attractive prices—these points ought to interest you.

This Light Four Regal has met with the public's hearty approval during the past year and with the refinements it now embodies, it offers the dealer an opportunity to sell the greatest number of car buyers.

Briefly the specifications are: 106-inch wheelbase—powerful motor—electric starting and lighting—genuine cantilever rear springs—full floating rear axle—one man mohair top—demountable rims—30x3½ tires and an attractive streamline body. That's full value for the money isn't it?

The Regal Motor Car Company

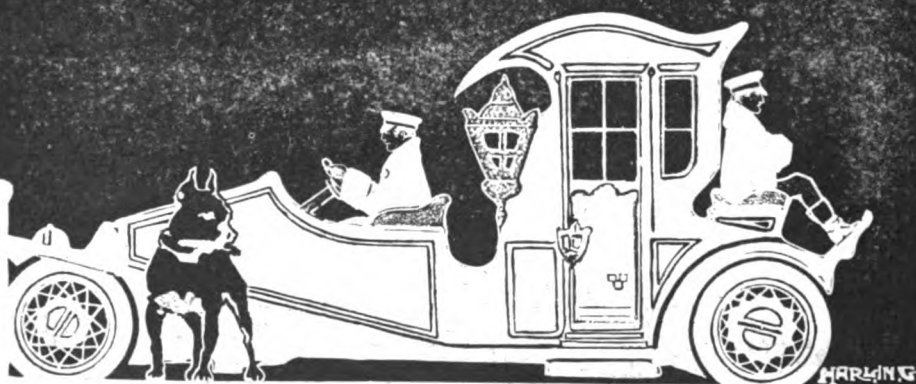
201 Piquette Ave., Detroit, Mich.



(When Writing to Advertisers Please Mention The Automobile Journal.)

BOSTON AUTO SHOW

MECHANICS BUILDING—
MARCH 4-11
1916



AUSPICES
BOSTON AUTOMOBILE DEALERS ASSOCIATION INC.

PERSONAL DIRECTION

CHESTER I. CAMPBELL

*There is **MORE POWER** in*
THAT GOOD GULF GASOLINE
AND SUPREME AUTO OIL

*Look for the Sign
 With the Orange Disc*

GULF REFINING CO.



The
FOX PNEUMATIC SHOCK ABSORBER

Has Double the Shock Absorption

Fox Pneumatic Shock Absorbers are "Built Like a Gun." They are perfected in design, workmanship and material.

Attractive in appearance—**GUARANTEED FOR LIFE**—easily and quickly installed, they can be adjusted for any requirement on any car.

DEALERS: *We have some open territory in New England. Write, wire or phone for our proposition. It's a money maker for us both.*

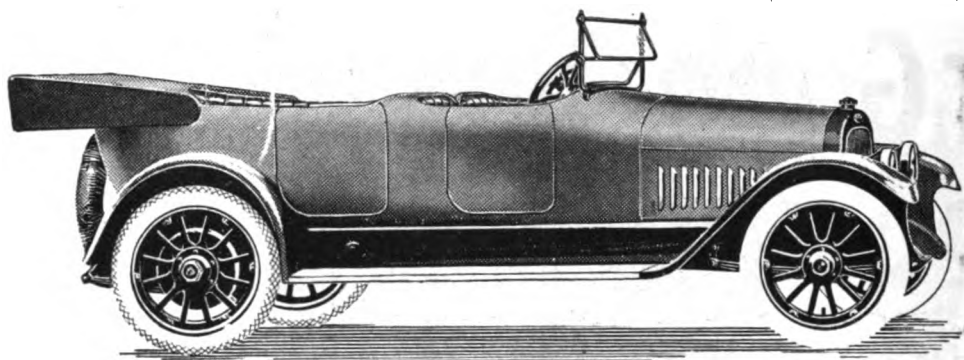
MOTOR SUPPLY SHOP Inc., 925 Boylston Street, Boston, Mass.

ALSO NEW ENGLAND DISTRIBUTORS FOR

ATWATER-KENT IGNITION SYSTEMS—DANN SPRING INSERT

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COLE 8



Refreshingly Different

Sameness in motor car construction and design, persistence in following the fads of the day, limit motor car accomplishment and performance.

The striking originality of the new, improved Cole 8 at \$1595 affords the prospective purchaser a distinct change from the other car styles and features offered this year. Its newness of lines and construction provide the utmost in beauty, in operating advantages, in economy.

The pronounced individuality of the new Cole 8 is easily apparent to the most casual observer at the show room or on the highway. The smart, distinctive appearance, the wonderful ease of operation are revelations. The experience of driving the seventy horsepower Cole 8, or riding in its big, luxurious seven passenger body is exhilarating.

It's a new kind of a car—new in appearance, new in its mechanical construction, new in its ability to perform. It establishes a new standard. Truly, the improved Cole 8 is a car that is refreshingly different.

There is still some open territory for dealers who are building a permanent business, and there is not a man or firm of this type who can afford to overlook the distinct selling advantages afforded by the improved Cole 8 at \$1595.

ALL PRICES F. O. B. FACTORY

Cole Motor Car Company, Indianapolis, U. S. A.

BUILDERS OF THE STANDARDIZED CAR

Now \$1595

The
GRAY & DAVIS
Starting-Lighting System

For **FORD** Cars

\$75

THIS system is as carefully built, as thoroughly tested as systems found on high-priced cars. A comparison of finish, workmanship, material and efficiency will sustain this claim. The material is the very best.

Gray & Davis Ford system is not an experiment nor an untried device, hastily contrived to meet the demand of Ford owners. On the contrary, it is the successful result of two years study of Ford requirements.

Backed by the name of "Gray & Davis," by an immense organization with a reputation for quality known and recognized wherever automobiles are driven.

Which Do You Care To Sell?

"Any old kind" of system, untried, unknown, or equipment which has a National reputation, which will give your customers satisfactory service under all conditions—the highly perfected Gray & Davis system.

Write for full information.

GRAY & DAVIS, Inc.

Boston, Mass.

Watch Us Grow!



The Eisner-Lenk Co.

**LARGEST EXCLUSIVE
ELECTRICAL
AUTOMOBILE
SUPPLY HOUSE IN
NEW ENGLAND**

IGNITION SPECIALISTS

We can promptly repair and adjust all makes of magnetos, generators, lighting and starting systems and guarantee the highest character of work at consistent rates.

New England Distributors for:

The Eismann Magneto Co.

Bijur Motor Lighting Co.

Pfanstihl Co.

American Ever Ready Storage Battery Co.

Headquarters for electrical parts, supplies and accessories.

When in doubt, try

The Eisner-Lenk Co.

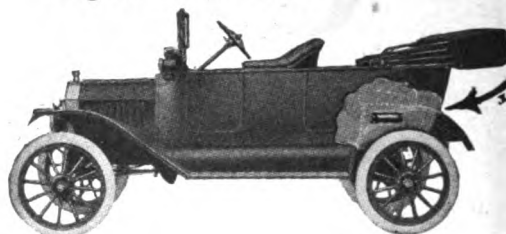
1096 Boylston St.,

Boston, Mass.

DOVER



The Dover Indestructible Head
Light Bulb Carrier



SOLVES THE PROBLEM

of having extra bulbs always ready in case of accident or breakage.

It is a round metal container with removable covers at each end---each cover is provided with a spring socket which holds the bulbs more securely than in the lamps. Keep your spare bulbs in the DOVER TWO-LITE BULB CASE, always ready when needed.

Carry it in your tool kit.

SEND FOR NEW CATALOGUE

DOVER STAMPING & MFG. CO.

Putnam Ave. Cambridge, Mass.

Dover Stamping & Mfg. Co., Cambridge, Mass.

(When Writing to Advertisers Please Mention The Automobile Journal.)



REAMER IN BOX
(Aligning Shaft Not Shown)

See It At the Boston Show

At Space No. 544 in the Boston Show, garage and service station men and car owners who have heard of the new method of reaming motor bearings can see a demonstration of the

MARTELL ALIGNING REAMER

This invention is saving time and avoiding trouble for garages and service stations all over the country because with it a set of motor bearings can be reamed in less than one-quarter the time required for hand scraping. It is also easy to secure absolute alignment, exact size of bearings, and perfect

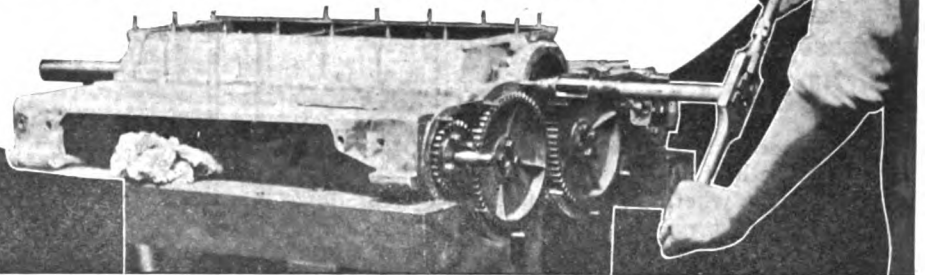
gear mesh. The work is so much better than when done by hand scraping that there is no comparison.

Now if you cannot look us up at the Show, just drop a line asking for our free booklet "A Better Way to Scrape Bearings."

HARDING MFG. CO.,

40 Court Street, Boston, Mass.

(67-20)



Cars That Never Grow Old

What do a few changes in body design matter, if your car is sound in its working parts?

Keep your car young by fighting friction in bearings and gears with



Wherever metal-to-metal contact sets up friction, NON-FLUID OIL inserts a lubricant film that prevents the parts from wearing, and makes motor cars run smoothly, silently, swiftly.

K-No. 00 Special Grade is for gears;

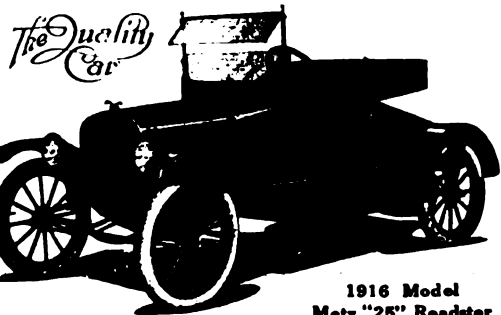
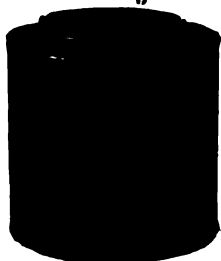
K-No. 000 for bearings. Get a supply from your dealer, or write for free samples.

Packed only in orange-colored cans

NEW YORK AND NEW JERSEY
LUBRICANT CO.,

165 Broadway

New York



1916 Model
Metz "25" Roadster

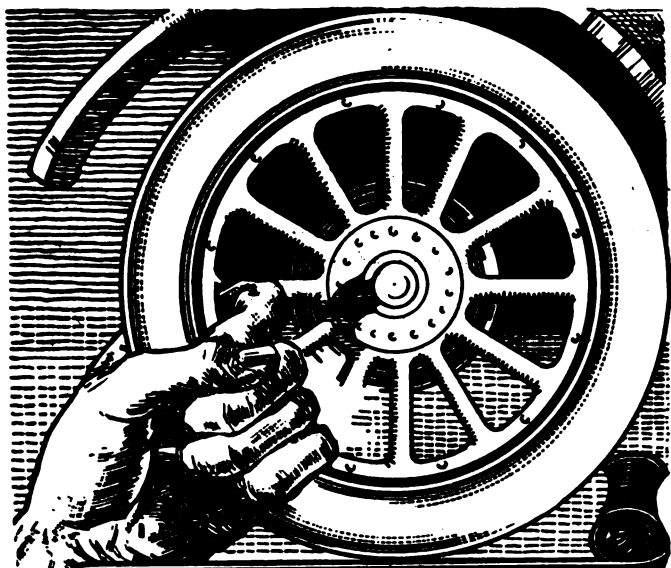
METZ

"25" Roadster, 1916 model. Price \$600, completely equipped. Built on same chassis as Touring Car, with 108-inch wheel base and carries identical equipment, including electric starter and electric lights, 25-horse power water-cooled motor, large wheels and tires, rain vision wind shield, instant one-man top, speedometer, built-in gasoline gauge, signal horn, etc. A wonderful hill climber, and for reliability in road performance is absolutely unsurpassed. Write for DEALER particulars and new illustrated catalog "Q."

NOTE—The Metz "25" Touring Car, 1916 model, completely equipped as above described, is also listed at \$600.

METZ COMPANY,

WALTHAM, MASS.



IT GRIPS - IT HOLDS

More automobile accidents are caused by the brakes failing when most needed

"Don't Gamble With Safety"

The security of those driving, riding or even in the path of a car is dependent upon the brakes, no matter whether moving fast or slow, in the city or country, in the open or in traffic.

Safety can be obtained by equipping the car brakes with



S-M-C BRAKE LINING
S-M-C brake lining is heat resisting and is not affected by grease, oil, water or dust. It is equally efficient until worn through.

There is a width and thickness for every type of brake. S-M-C brake lining is sold by all dealers who regard quality as an essential for business, and all repairmen will install it on brakes if it is specified to them.

Your safety and your economy are conserved by demanding S-M-C brake lining. It is trade marked and it is guaranteed to give complete satisfaction in any service and on any vehicle. It costs no more than inferior quality, and measured by service it is much cheaper.

There is a special S-M-C set of transmission bands for Ford cars, cut to size and supplied with rivets "easy for applying"

"SAFETY MEANS CONSIDERABLE!"

STAYBESTOS MFG. CO.

Germantown, Philadelphia

Maker of Asbestos and Rubber Packing, Gaskets and Radiator Hose, Etc.

NEW DEPARTURE BALL BEARINGS

American Made
FOR
American Trade
QUALITY
FIRST

THE NEW DEPARTURE MANUFACTURING CO.
CONRAD PATENTS LICENSEE
BRISTOL, CONN., U.S.A.

MASTER

CALORITE SPARK PLUGS

The highest achievement in spark plug construction—All standard threads carried in stock—Master Calorite Spark Plugs are backed by this broad guarantee—
"We guarantee Master Calorite Spark Plugs against defects of material or workmanship and will replace free of charge any Calorite insulators broken by heat which are returned to us transportation prepaid".

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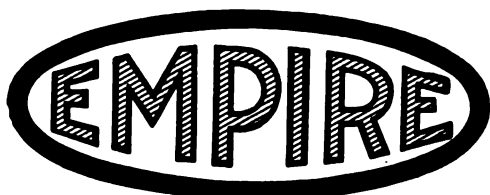
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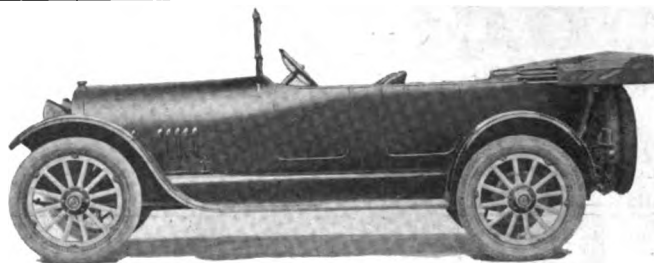
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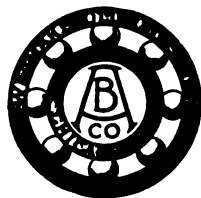
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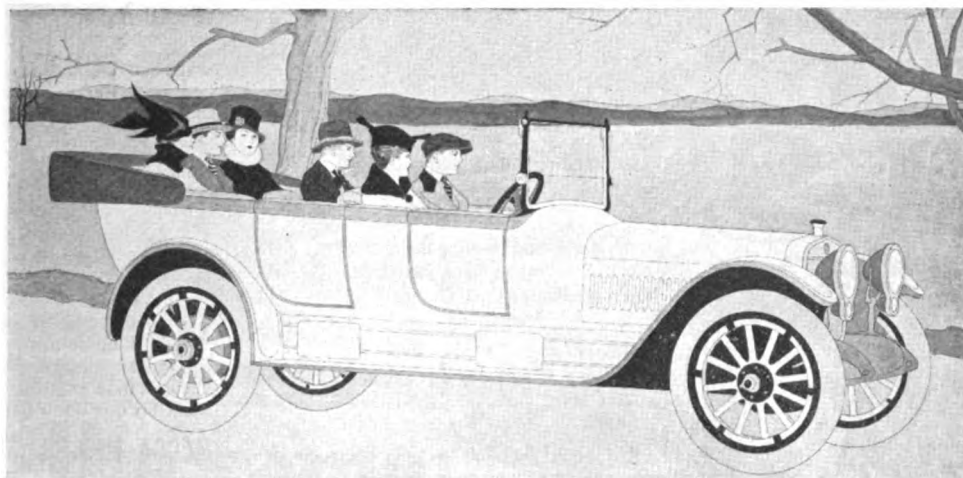
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Entered as second class matter, April 15, 1906, at the Postoffice at Pawtucket, R. I., under Act of Congress of March 3, 1879

VOL. XLI.

MARCH 10, 1916.

NO. 3.

The Publisher's Comments

THAT Motor Car Tourists are already laying their plans for the coming season is made evident by the inquiries being received by the Editor of the Touring Department. As in the past, this department of The Automobile Journal during 1916 will be one of the most important in the magazine, and will continue to serve the readers by presenting accurate and illustrated itineraries in various parts of the country and to serve inquirers by giving special information either through the department's columns or direct by mail. The Editor has arranged to give all the information desired as promptly as any one could wish. This service is free to all subscribers.

Several Readers Have Submitted suggestions relating to the maintenance, operation and repair of motor vehicles. The Editor of the Technical Department is duly appreciative and takes this means of acknowledging their receipt. For the benefit of those who are not acquainted with this feature of the magazine, it is to be said that readers are offered the opportunity to exchange practical ideas in these departments. The hints should be practical and it is advisable that each of a mechanical nature be accompanied by at least a rough sketch to illustrate the idea. The Automobile Journal has presented hundreds of hints from readers during past years and this co-operative service has been greatly appreciated by all concerned.

The Model T Ford Car has been the subject of thousands of articles and books during the past year, but in none has there appeared such valuable text and illustrations as is contained in the series in The Automobile Journal and appearing under the department head of Suggestions for the Ford Car Owner. This is the consensus of opinion among those who know, as is shown by the letters received in the publication office. In the matter of photographs alone the reader receives a liberal education in the mechanics of this popular make of car.

Automobile Legislation, as legislative enactments and proposals effecting motor car owners and operators are frequently called, is a subject in which every reader of this magazine is interested. It is the policy of The Automobile Journal to co-operate with organizations working for uniform and more beneficial laws by giving publicity to such efforts. Much has been done in the past—more will be done in the future. Those persons interested in such matters should address their letters to the Editor.

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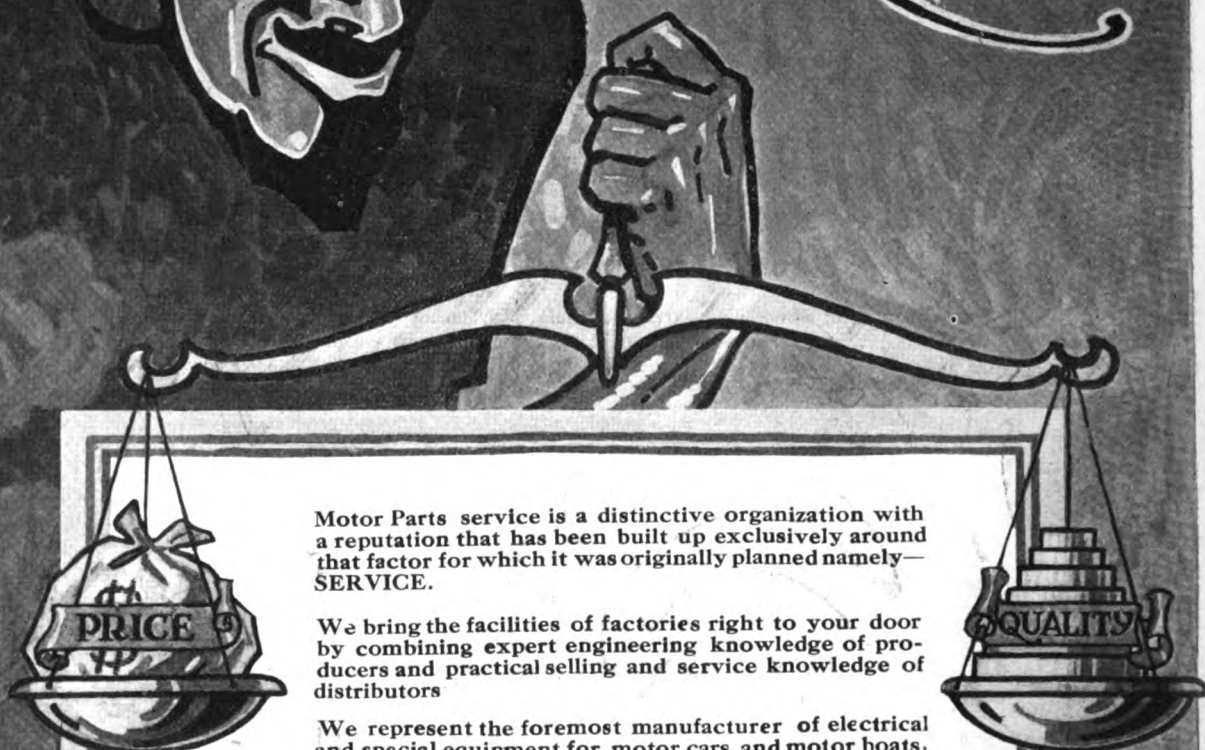
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AUTOMOBILE JOURNAL

BOSTON SHOW
A GREAT
GATHERING
OF BUYERS

VOL. XLI



**PROSPECTIVE PRICE
INCREASE
SPEEDS UP
BUSINESS**

No. 3

MARCH 10, 1916

THE YEAR'S MOST SUCCESSFUL SHOW.

THOUGH the Boston Automobile Show was extraordinarily well attended by actual prospects and buyers, though the decorations were magnificent and the displays complete and exceptionally interesting, the feature that marked it off sharply from the successful Boston shows that have gone before was the realization of the materials shortage, the impending car shortage and the now almost assured increase in the price of many cars.

Even at the beginning of the show announcement was made that one of the greatest and best advertised of the producers, the Studebaker Corporation, had increased the prices of its various models about \$30 per car on the average, and this was regarded everywhere as another important indication of what was to come.

Informed buyers who follow the market closely arrived at the show already possessed of this knowledge, and those who did not realize it were not long in the atmosphere that prevailed in the various booths before they appreciated the situation.

This had a favorable influence on the selling of cars, for those who were fully determined to buy decided to place their orders at once in order to take advantage of the present price level. It was not long before the news had spread all over the field tributary to the show and the result was that buyers in great number descended upon the exhibition in its closing days.

The weather was very unfavorable during the early part of the week. Wet snow had left New England with several inches of slush and it was unpleasant to be about. But by Tuesday the attendance was as large as it could be to afford opportunity for first class sales work. Furthermore, the bad weather had the effect of keeping out the merely curious, so that the crowd which came was on the whole deeply interested in motor cars and intending in many cases to buy. By

Wednesday afternoon the throngs in the hall were so dense that it was difficult to move around. The attendance for the week was over 300,000 and was the largest that has attended a Boston motor vehicle exposition.

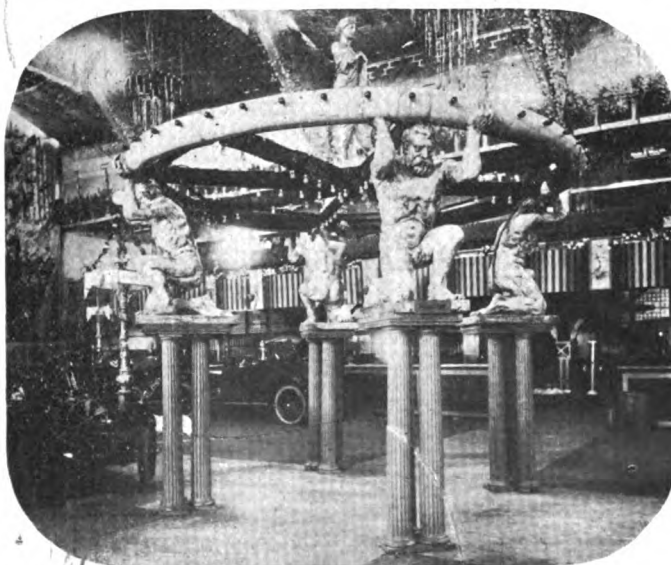
Tuesday night was governor's night and the show became a gala affair through the presence of Governor McCall, with his family and members of his military staff. This is usually the big evening of the show from the standpoint of attendance and the number of people who visited was very large.

The Mechanics' building is one of the most spacious show structures in the country and its arrangement is such that the visitor may comfortably see the entire exhibit in a comparatively short time. Every nook and corner of the great building was in active use for exhibition purposes and, although 70 makes of passenger cars and 39 makes of trucks, not to mention nearly 100 accessory exhibits, were shown, more than a score of vehicle exhibitors who desired representation could not be accommodated. Should the pressure next year be as great, either a separate truck show must be held or additional space secured in another building.

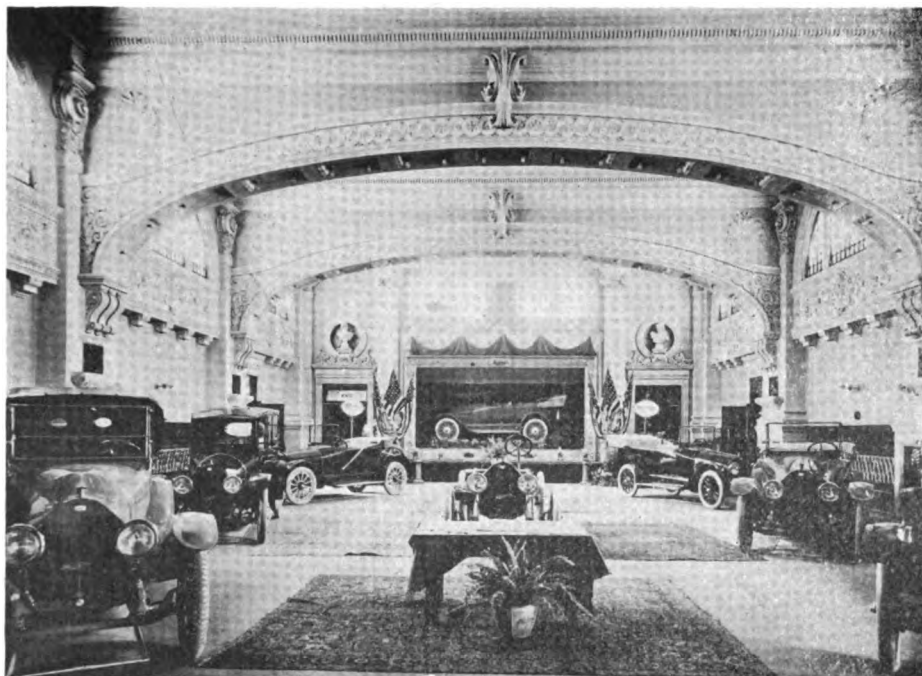
But as it was the visitors had opportunity to examine \$1,000,000 worth of vehicles, which incorporated all of the interesting mechanical features that have been developed during a year of exceptional engineering enterprise.

Great interest was shown in the eight and 12-cylinder cars. The advertising and educational campaigns of the makers have established these motors as standard types and lifted them out of the realm of novelties. The Packard, Pathfinder and National 12's and the Cadillac, Cole and other well known eights shared the interest shown in the multi-cylinder machines.

Appearance, light weight, comfort, economy and simplicity seemed to be the points on which the buyers concentrated. The type of snappily designed light car of distinguished Euro-



The Symbolic Wheel in Grand Hall.



The Mitchell Exhibit Occupied the Whole of Paul Revere Hall.

pean lines is unquestionably attractive to a large section of the public. Young women particularly, and young men as well, showed great interest in the handsome Scripps-Booth exhibit, while the Boston-made S. J. R. car, built along the most advanced European lines of body design, was also very successful in drawing this class of buyers. The double-cowl Detroit six, different in appearance, but still designed for the person who desires something distinctive in a light and economical, but distinguished car, was examined with much admiration.

Black Tread Tires on View.

Another departure from that which has been customary in the past, and which caught the eye of the visitor at once, was a number of the new black tread white walled tires which have come into prominence as a result of a shortage of white materials brought on by the war. They are handsome and distinctive features and add something to the appearance of the car, even though, as tire experts declare, the color of the rubber has no relation whatever to its quality.

Numerous designs of the cloverleaf roadsters, one of the important innovations of the year, were to be observed. The Kissel-Kar exhibitor had an attractive example on the floor, it having a blue gray body and brown running gear. The two rear seats were made to fold down so that when the car is not in use they form a continuation of the rear deck.

There were two models at Boston that had not made an appearance at any previous exhibits in this country. One of these was the Roamer, a five-passenger car selling for \$1800. The chassis is made by the Barclay Manufacturing Company from standard parts. The bodies are the product of a firm in Fleetwood, Penn., which has specialized for years in fine coach work. It is a Rutenber six-cylinder motor, Bosch ignition and is a standard product throughout.

The other new car was the small four-cylinder Monroe roadster. Its price of \$495 includes a complete lighting and starting system.

A touch of the luxuriousness of the automobile salon held usually in New York City was given the show by the

presence there of several expensive and well known European cars, such as the Lancia and Fiat. But the war has robbed these of much of their interest. It has prevented European engineers from making their usual contributions to automobile design, with the result that both in body work and mechanical structure the imported cars had the appearance of great conservatism, as compared to the most recent and attractive productions of the American makers. They attracted probably less attention than at any previous show.

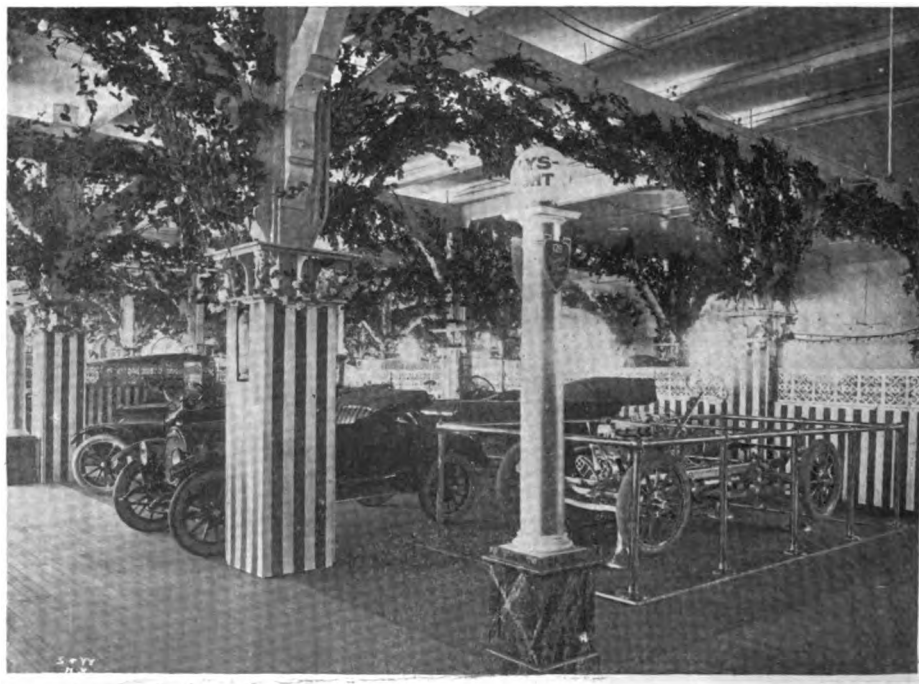
The Buick exhibit was placed in Exhibition hall, at a point where the light was not particularly good in the day time, but this condition was converted into a marked advantage by the exhibits being railed in by brass work and surrounded by special lighting arrangements that threw a strong white light on all the cars. The chief figure in the exhibit was a roadster finished in white and mounted on a turntable. It was upholstered in gray leather and bore a coat of arms on the door panel.

To afford a view of its six-cylinder chassis from all angles the Oakland Motor Company mounted one that had been stripped of body and all equipment, so that it could be turned over in a frame. The motor was in operation, power being drawn from an electric motor, and small electric bulbs on the sides of the cylinders showed the order of their firing. The lower part of the engine was open so that the operation of the whole mechanism could be observed. The overhead valves also were shown as they opened and closed.

Mitchell Display Impressive.

One of the most impressive displays, because it had the largest and most uniquely arranged setting, was the Mitchell, which occupied the whole of Paul Revere hall. "The Six of '16," a handsomely colored car, with brilliantly striped upholstery, was set on the small stage at an end of the hall and surrounded by flowers and a frame, so that it had the appearance of a great picture.

The Packard and Cadillac exhibits occupied the stage in the main hall, and although there had been very little effort made toward especial decoration or display, they were among



The Willys-Knight Exhibit in Exhibition Hall.



Exhibition Hall, Showing the Cars Below and the Accessory Galleries Above.

the most crowded in the show, owing to the reputation of the cars, especially in the New England territory.

The Pathfinder, for which representation in Boston and the New England states has recently been acquired by the Cottrell Motor Company, of which Charles M. Streiby is the head, was on display. There were several examples of this handsome 12-cylinder model and they attracted great attention. It is being marketed in Boston on a guaranteed service plan, each car carrying 150 half hours of service work.

For a comparatively new light car the Dort received a great deal of inspection. Interesting features of the motor design especially attracted the visitors. The cylinders are cast separately and there are two exhaust manifolds, each of which serves two cylinders. These have been found to clear the engine of burned gases with exceptional efficiency and are claimed to greatly increase engine efficiency.

C. P. Henderson, general sales manager of the Cole company, who was one of the big men of the industry to be present at the booths, said that while the rumored combination of Indiana plans around the Cole organization might not go through as originally planned, the line up of necessary parts plants behind the Cole itself was assured. He also said that A. F. Knobloch, formerly general manager of the Northway Motor Company, and one of the significant figures of the General Motors group, had assumed the general management of the Cole company and was rapidly bringing to pass the increased production and manufacturing efficiency which it was the chief object of the combination to secure.

On the fact that it is one of two multi-cylinder car makers that has had the benefit of a full year's test of its product in the hands of users, the Cole company is basing a very successful sales campaign in the New England territory.

More Stutz cars are sold every year by the Boston distributor than by any other in the country. Several examples of the Stutz, one of them in red with handsome red leather upholstery, formed the exhibit. Being the winner of last year's speedway

races, the models received a large measure of critical examination by motor-wise visitors.

The National Highway Twelve and Six were present and were furnished with handsomely finished open bodies. Mechanical excellence, accessibility and riding qualities secured from long cantilever springs were the features that proved a lure for the crowds.

Allen Expands Its Field.

A car which has been creating something of a stir in motordom is the Allen, a large and comfortable five-passenger machine which sells for \$795. A year ago it was sold by 75 distributors in the states near Ohio, where it is made, and now there are 600 who thoroughly cover the Pacific and the southern sections, as well as most of the Atlantic slope and the middle west.

It has a boat line design of striking grace, an amply spacious body, a flat single 55-inch spring, which has eliminated all rebound and is half as long as the car. The show display was in charge of R. G. Ewell.

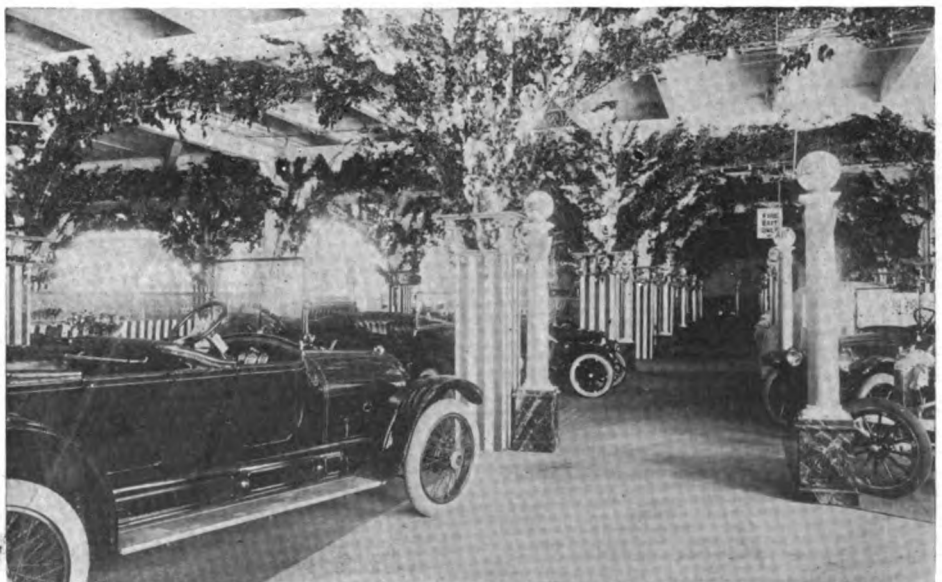
Another novelty introduced at this year's exposition that indicates progress in a direction much desired by workers for women suffrage was the appearance of the first saleswoman. She was stationed at the booth of the Milburn electric. It is doubtless the theory that as that type is largely a woman's car a saleswoman may handle it more successfully than a man. The experiment appeared to be a success.

Six and eight-seated Ford cars for the use of hotel, jitney and livery men are a novelty given to the world by L. M. Cotton of Boston. He reinforces the ordinary Ford chassis, greatly lengthens the wheelbase and then adds seats very similar to the standard rear seat of a touring car. The complete machine is surprisingly good looking and is finding a good response in the market to which it appeals.

The famous gold plated chassis which has been the chief attraction of the Studebaker exhibit in this season's various shows was a little late in arriving in Boston, but when it was placed in the booth it became again the centre of admiring crowds. It has proved, even more than its sponsors hoped, an attraction possessing great power to hold the people.

Further emphasis was given to the popularity of the cloverleaf roadster design by the Winton company, which mounted that type of body on a 48-six chassis. This model has only a single seat in the rear instead of two. The car is quiet, dignified and handsome and carried white wire wheels and a black body. A 48-six limousine, with body in beaver brown, exemplifies the new Winton practise of placing the lighter color at the top.

Keen interest was shown in the mechanical features of the Owen magnetic. The electric transmission has been one of the really important constructional advances of the year and the car was one of the most discussed. The body work is of the finest type. The models on display included a cloverleaf roadster of four-passenger capacity and a sedan



A Wire-Wheeled Overland in Exhibition Hall.



The Main Aisle of Accessory Exhibits.

rated at four-passengers, but is really roomy enough to hold five.

Still another cloverleaf design was shown by the Abbott-Detroit. This unique car is known as a motor coach. It has a sloping adjustable glass front and two oval port holes in the top. The standard trimming is black and the effect is both unusual and surprisingly attractive.

White's Distinctive Cars.

The White passenger car exhibit was one of the most impressive. All models were equipped with the new white wall black tread tires. One of the features of the display, every car of which suggests the work of luxurious custom builder, was the Coupe Ville, a French type town model. It is very light, has a special spring suspension and a short turning radius for manipulation in crowded streets. The car has seats for four persons inside and for two men in livery on the outside.

The Pierce-Arrow showing, as usual, was greatly interesting as well as being one of the largest of the exhibits. The designs were conservative, closely following previous Pierce-Arrow practise. One of the most interesting was a convertible French coupe for town use. The driver's seat is open, but has a curtain for stormy weather.

The Metz has especial interest for New England motorists, due to the fact that it is made in the largest motor car plant in the section. It is unique in that it embodies the friction drive which eliminates the gear box and supplies a small, light car with complete electric system at a very moderate price. The men behind the company have been identified with the industry almost from its inception.

Both models of the Briscoe put on the market since the company absorbed several parts plants and expanded into a big producer, were on display at the company's booth. They combine the type of light, efficient, inexpensive car with that touch of distinguished appearance which characterizes the specially fine light car.

The Reo display had touring cars and roadsters of both the four and six types, the differences between them being only in engine design and passenger capacity. Three examples of the Grant Six, a touring car, roadster and cabriolet, formed the very attractive display for that company.

One of the new cars that has never been shown in Boston previously and which attracted much attention, was the Fostoria light car. It is a four-

cylinder touring model with 108-inch wheelbase, Allis-Chalmers lighting and starting system and complete equipment.

Five cars and a chassis, including all the different touring models made by the Willys-Overland company composed the Overland exhibit, which owing to the position of the car in the market as to quality and price was, as it always is, a centre of great interest.

The Marion-Handley seven-passenger, 45-horsepower touring car provided a handsome, attractively colored display. The feature of the Locomobile show was a custom made body with a cowl and windshield in front of the back seat and a very low victoria top. To enter the rear it is necessary to tip up the cowl, which is swung on hinges. The usual careful attention to minor detail that is characteristic of Locomobile production was visible in every model shown.

A new car that has just been placed on the market and is therefore keenly interesting to prospective buyers, is the new light weight Jeffery Six, shown by C. P. Rockwell, Inc. This is a 121-inch wheelbase model, which weighs a little more than 3000 pounds and is an advance in style and appearance on even the high Jeffery quality of the past.

An Empire touring car, with a light brown body was a conspicuous exhibit. The four and six-cylinder chassis, with bodies for five passengers in both cases, were shown by the F. A. Dutton Motor Company. A five-passenger touring car and a two-passenger roadster made up the display of the Interstate company, which was shown along with the Briscoes.

Year's Largest Truck Show.

The truck exhibit, filling the entire basement of the building, formed a large part of the show. It was very complete, covering practically every type of standard commercial vehicle and many special jobs, which differed from the standard both in chassis and bodies. A full description of these exhibits will be found in the Motor Truck for April. The vehicles displayed were as follows: Autocar, Buick, Chase, Commerce, Cunningham, Denby, Diamond T, Federal, Garford, Henderson, International, Harvester, General Vehicle, Indiana, Jeffery, Kelly-Springfield, Knox Tractor, Lippard-Stewart, Locomobile, Mack, Martin Tractor, Metz, Menominee, Netco, Packard, Pierce-Arrow, Reo, Saurer, Selden, Signal, Stewart, Studebaker, Transport Tractor, United, Vim, Ward Electric, White.



White Trucks in the Basement.

There were in Mechanics' building approximately 100 stands displaying accessories for the motor car. Each was prettily decorated and the public was given practical demonstrations of the equipment. A person could easily spend a full day in the department, as each dealer handled several different lines of accessories which he wished to demonstrate and describe in full. This made the 100 exhibits equal to three times the number of manufacturers' exhibits. A feature was the number of different types of devices for preventing headlight glare. These were fitted to high powered headlights and the rays were flashed up and down the aisles to demonstrate that all glare was removed.

Tire Exhibits Were Complete.

There was a complete exhibit of tires. The construction of these was fully explained by the dealer. Old tires were prominently displayed and accompanied with sworn statements as to the mileage which they had given. Some exhibitors had tires which were non-puncturable. As proof of the statement large spikes would be driven into them and then withdrawn. No air would escape. Other dealers attempted to show the public that it was more economical to use those which did not require an inflated tube.

Electrical and mechanical car starters were effectively displayed. The Genemotor, which is distributed by A. J. Picard & Co., 1720-22 Broadway, New York City, was shown attached to a Ford engine. The demonstrator explained its features, construction and the value of the shaft drive to the engine.

Of the specialties for renovating the appearance of the car the Boston Blacking Company's exhibit was of special interest. The line included a body, brass and nickel polish, hand cleaner, top lining dye, car soap, cushion, mohair top and leather dressing, metal and body finish, tire paint and seat and slip cover cleaner.

The demonstrators at the G. H. Dyer Company's stand were kept busy explaining the line of equipment manufactured. The simplicity of operation of the reaming tool and jig for reboring Ford, Metz and Buick cylinders was made clear. The welding and carbon removing outfits produced by this company were also attractively displayed.

A practical demonstration of the high quality of Dixon's graphite automobile lubricants was given. By peering through a hole in a glass case one could see transmission gears revolving in graphite grease. When the gears were stopped the demonstrator drew your attention to the fact that the grease did not run off the teeth. Another feature of the Dixon display was a spring which was held securely at both ends and forced upwards and downwards at the centre. Great flexibility and longevity was afforded by the graphite being between the spring leaves.

Of great interest was the exhibit of shock absorbers. There were several kinds and types. A notable one was the Hassler. It was displayed as in actual service, fitted to the spring of a Ford car. The demonstration convinced the bystander that they insure easy riding, comfort, safe driving and easy steering under all conditions.

Interesting Auto Jacks Displayed.

There were two auto jacks shown. The Kimball jack was of special interest because of simplicity and ease of operation. It has a long handle, which allows the operator to raise the car while standing well away from it. It is of the screw type and operates by turning the handle. At the show the demonstrator raised a weight of over 5000 pounds simply by twisting the handle with one hand.

Camping and luncheon outfits, blankets, robes, canvas water pails and tents commanded much of the attention of the tourist. Wrenches and other tools were shown in actual usage. Because of the present high price of gasoline, tablets and liquids, which mix with gasoline so as to give a greater

mileage per gallon of fuel, were of special interest. There were also many carburetors for which economy of fuel consumption was claimed.

Victrolene, which is manufactured by the Dorsey Manufacturing Company, was demonstrated to clean and polish the car in a single operation. It will remove tar, asphalt, tarvia, road oil, grease and oil from automobile bodies without affecting the finish.

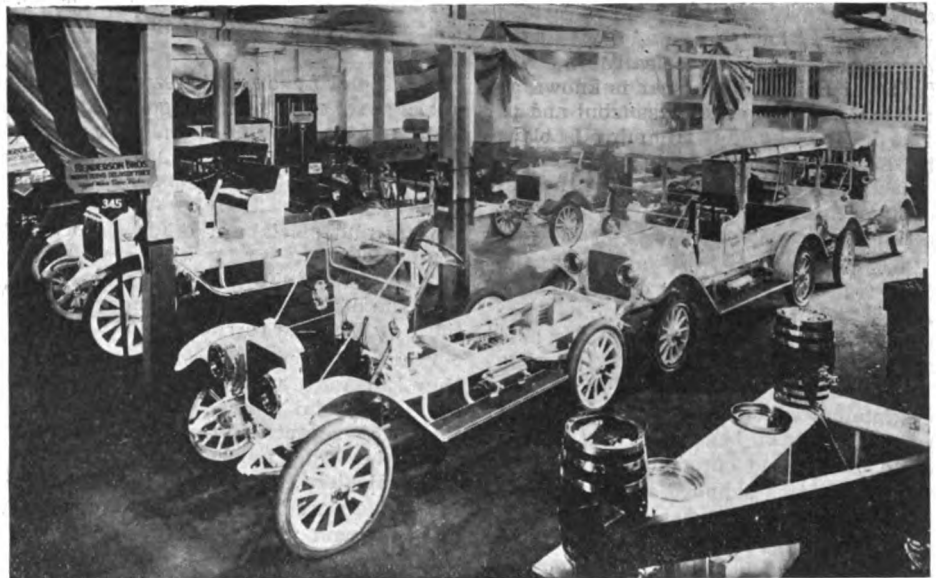
There were numerous automobile oils exhibited, among them Eagleline, a grade of which is made for every type of motor. The line was attractively displayed and there were numerous descriptive circulars for all who wished to take them.

The Waterhouse Welding Company's exhibit was worthy of special mention. Complete welding outfits were conspicuously displayed. Another feature was a two-wheel, rubber tired truck for conveying heavy gas tanks.

Multibestos, which can be used either as a brake lining or clutch facing, was shown at one of the booths. The material was open to inspection and the person in charge explained how it guards the safety of a million users.

Splitdorf's Booth Was Attractive.

R. M. Ellis, Boston branch manager of the Splitdorf Electrical Company, was in charge of the display of that concern, one of the chief features of which was the starting and lighting system for Ford cars. This is equipped with a neatly designed bracket by which chain play can be taken up, thus in-



Signal Worm Drive Trucks in the Basement.

sure quiet running. Almost no machining is necessary to fit the system, only a small cut in the fan pulley being required.

One of the largest and most attractive exhibits was that of the Champion Spark Plug Company. It was pointed out to the motorist that Champion quality has received recognition from a number of the greatest car manufacturers and that these plugs are standard equipment on Fords, Overlands, Studebakers, Maxwells and over 85 other makes of cars. There is a plug for every type of motor car, motor truck, motorcycle, motor boat, aeroplane or stationary engine.

In the displays this year there were only two makers showing garage gasoline and oil tanks used in selling supplies. One of these was the Standard Oil Company of New York and another the Eastern Oil Tank Company of Lowell, Mass. Some of the oil companies are now supplying curb tanks with their own advertising upon them in connection with contracts for the sale of their gasoline and oil.

Two exhibits not connected with the motor trade was one of the United States navy, showing shells for naval guns, and equipment and supplies of the lighter sort that are used by marines and sailors. The other was a space given over to the moving picture producers in which pictures of the famous film stars were displayed. Motorcycles and bicycles also had a place in the displays.

MANY BANQUETS AT BOSTON.

One of the Features of the Show Was the Numerous Gatherings of Industrial Men at the Hotels.

During Boston show week many banquets and dinners were given. Some of these were under the auspices of organizations of various sorts and others were given by companies to their New England dealers, of which about 3000 attended the show.

One of the first of these gatherings was the round-up of Mitchell dealers, which was held at the Copley Plaza on Tuesday. Over 100 men gathered to hear talks on the past and future successes of the Mitchell car.

Sales Manager Otis C. Field was the toastmaster. The designer of the car, one of the big figures in the industry, John W. Bate, spoke of the success achieved by Mitchell dealers throughout the country as the result of the car's performance. J. W. Hipple spoke of various sales stimulation plans and Carl Page, who represents the company in New York and Philadelphia, spoke of the sensational results accomplished by him since he took up the line. F. H. Lucas, the Boston distributor, who was much praised for his exhibit, spoke on the difficulties encountered in getting the cars in time for the show.

Perhaps the greatest event of the week, from the standpoint of attendance, was the stag gathering of the Bay State Automobile Association, which was held in Convention hall on Thursday evening. There were 5000 men in attendance. The programme, which was arranged by Dr. Arthur McIntosh, began at 10:30. There was a dinner and entertainers from the various theatres supplied amusement.

On Thursday also officials of the Maxwell company and dealers from all parts of New England held a get-together dinner at the Hotel Westminster. It started at 2 o'clock and occupied the greater

part of the afternoon. There was considerable pleasure and much Maxwell enthusiasm.

S. W. Munroe was the toastmaster and the chief speaker was John J. Plath, the Maxwell sales manager, who had for his topic "The Maxwell Sales Organization." Other speakers and their subjects were: L. F. Smith, special representative, "A Request;" S. A. Stewart, Maxwell dealer at Worcester, "Why I Am a Maxwell Dealer;" R. F. Coburn, Maxwell dealer at Boston, "The Dealer's Point of View;" William H. Draper, "Organization;" Clyde H. Smith, Maxwell dealer at Skowhegan, Me., "Maxwells and Potatoes in Maine;" W. P. Tupper, Maxwell dealer at Burlington, Vt., "Concentrated Sales Effort." G. T. King spoke on "Maxwell Service." Parodies of popular songs, arranged to express Maxwell ideas, were sung.

The Hotel Lenox, which was the headquarters for most of the automobile men, was the scene of the Chalmers banquet, at which Paul Smith, vice president, addressed 200 of the company's distributors. As guests there were numerous dealers and officials of other motor car companies. The dinner was arranged by O. L. Halsey, who has recently taken over the distribution of Chalmers cars in the New England territory.

Frank P. Allen, sales manager for the New England Chalmers Company, was a very successful toastmaster. Mr. Smith told of his recent trip through the South, where he found much motor car enthusiasm. Dealers there, he said, were rushing in their orders now so as to have the cars on hand when the big buying season begins.

He described some of the features of the sales work, such as territorial infor-

mation bureaus for the exchange of information and tips. Other speakers were L. A. Van Patten, the company's advertising counsel; W. J. Drumpelmann, assistant sales manager of the company; Gail Murphy, advertising manager; Frank Sumner and Fred Markee.

At the Copley Plaza on Wednesday, George C. Hubbs of the Dodge Brothers sales department met the company's New England dealers at a dinner. The affair was arranged by Charles S. Henshaw of the Henshaw Motor Company, and by District Manager Day. The speakers went over the various features of the New England automobile situation and the dealers were thanked for their efforts in placing the Dodge among the five leading cars of the country in the point of volume of sales.

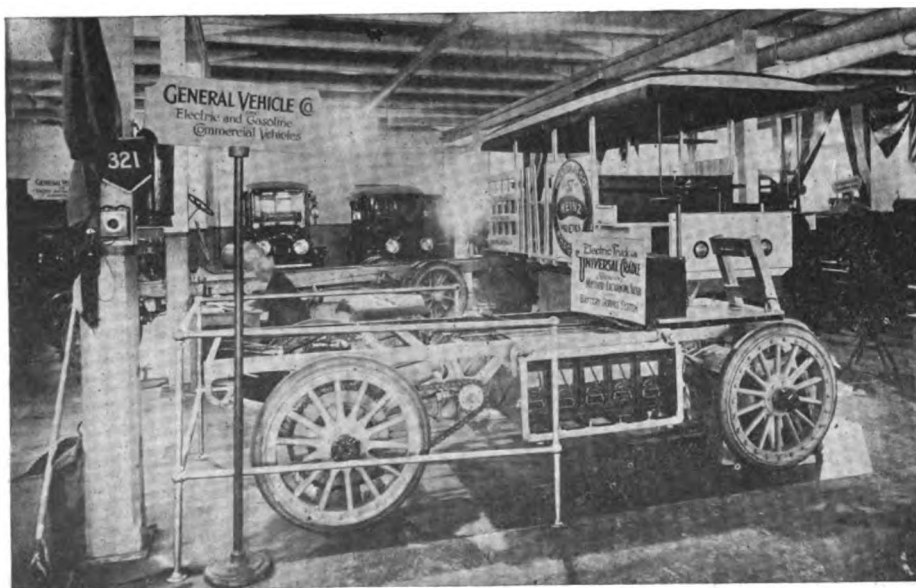
F. S. Bennett, Cadillac distributor in London, was the guest of Cadillac officials and dealers at the dinner held Wednesday at the Hotel Thorndike. One hundred Cadillac dealers from all parts of New England were present. Earl C. Howard, general sales manager of the company; L. McNaughton, assistant sales manager; C. B. Chandler, New England district representative, and I. M. Uppercue, New York dealer, were among those present. After dinner there was a discussion, during which Mr. Bennett entertained those present with tales regarding the sales of Cadillacs in England during the war.

Two hundred Willys-Overland dealers from all parts of New England gathered at the Copley Plaza Wednesday evening for the annual New England dinner. W. B. Sawyer, New England sales manager of the organization, presided, and the first speaker was L. D. Gibbs, advertising manager of the Edison Electric Illuminating Company. He discussed the value of personal contact between an organization and its patrons and told how his company encouraged its men to make as many acquaintances among customers as possible.

Service, he said, was the sixth sense of the business man and it requires that he be constantly on the alert to be helpful and friendly to his customers. Other speakers were H. B. Harper, Overland sales manager, and Joseph H. McDuffee and H. H. Hower, his assistants.

DIXIE MAGNETO ON METZ.

In the description of the low priced cars shown at the New York show, which was published in the Dec. 25 issue of *The Automobile Journal*, it was inadvertently stated in the reference to the Metz car that ignition is supplied by a Bosch magneto. The Splitdorf Electrical Company, Newark, N. J., corrects this statement with the announcement that this car, as well as many other well known makes, is provided with a Dixie magneto, which the Splitdorf company manufactures. Twenty-four of the cars equipped with this make of magneto are named in the company's advertisement that appeared in the Feb. 25 issue of this magazine on the first inside cover.



General Vehicle Electric One of Two Makes of the Type Shown.

PULLEN WINS AT LOS ANGELES.

Driving a Mercer, He Averaged 66.1 Miles Per Hour—Bob Burman in a Peugeot, Second.

EDDIE PULLEN, in a Mercer, won the Washington Sweepstakes, the 100-mile race which was the feature event at the Ascot speedway in Los Angeles, Sunday, March 5. His time was one hour 30 minutes and 42 seconds, an average of 66.1 miles per hour. This is very good for the course, which is a one-mile dirt track banked at the turns.

The field was an especially good one, with many of the leading race drivers participating. Bob Burman, in one of the Peugeot cars which showed remarkable speed at Sheepshead Bay, was second. Earl Cooper, in a Stutz, was third. Dave Lewis, in another Mercer, was fourth, and Eddie O'Donnel, in a Deussenberg, was fifth.

This is Pullen's second victory on the track within the past few weeks. On Dec. 26 he won a spectacular inaugural 50-mile invitation race.

MERCERS IN CORONA RACE.

Mercer cars will have an important part in the Corona Grand Prix boulevard race to be held at Corona, Cal., April 8. Eddie Pullen, who will drive one of them, is the holder of the present world's road racing records, made on the same track—a three-mile circle about the town—on Thanksgiving day, 1914. Joe Thomas, who previously was Pullen's mechanic, will be at the wheel of another Mercer. Both cars will be entered by George R. Bentel.

The distance of the race will be 300 miles. The fact that it holds the present record, its speed in the Vanderbilt and Grand Prize held on the Pacific Coast last year and its recent victories on the Ascot speedway at Los Angeles, make the Mercer entries especially interesting to the public.

MAINE'S REGISTRATIONS.

The automobile business done by the secretary of state of Maine has increased until it constitutes about two-thirds of the work done by his office. A very large force of clerks and stenographers is required. It was suggested last year that this work be transferred to the highway commission, but objections arose and it was not done. The step may yet be taken, however. Collections of the department amounted last year to \$168,000, and this year they will come approximately to \$280,000, it is expected.

ACCIDENTS DECREASING.

Figures compiled by the Census Bureau indicate that while the number of motor cars is increasing with tremendous rapidity, the increase of accidents due to motor car operation is not in proportion. There is a steady lowering of the ratio.

From 1909 to 1914 the number of accidents increased only half as fast as the number of cars.

At the end of 1909 the number of motor vehicles in use in the United States was 200,000; by the close of 1913 it had risen to 1,270,000, and a year later at the end of 1914, it was 1,750,000.

In the meantime the number of deaths in the death registration area increased from 632 in 1909 to 2623 in the same area in 1914. The increase from 1913 to 1914 in the death registration area as it then existed, including 65 per cent of the population of the country, was from 2488 to 2795.

Thus a five-year increase of 775 per cent. in the number of motor cars was accompanied by an increase of 315 per cent. in automobile fatalities. A one year increase of 38 per cent. in the number of cars was accompanied by an increase of 12 per cent. in the number of casualties.

One cause of this proportional decrease in the destructiveness of the automobile is to be found in a reduction in the average annual mileage per machine, but after due weight is given this factor the conclusion must be reached that the automobile is being driven with more care than a few years ago. The improvement in automobile mechanism has also had an important influence on the problem.

BIG 'BUS DEVELOPMENT.

After the European war, when the large outputs of American truck producers are fully released for domestic consumption, there will be a great development of interurban 'bus lines and 'buses operated in the cities, according to H. W. Parry, statistician for the National Automobile Chamber of Commerce. There is one large 'bus company in New York City now, and the authorities are considering the advisability of granting a franchise to another and still larger service. In Chicago the subject has been under an investigation which is likely to result

either in municipal 'bus lines or in franchises for private concerns.

The 2,500,000 passenger cars in the country, of course, give the greatest amount of motor transportation. They average annually about 5000 miles each, or 13,000,000,000 passenger miles together. They do not cut the railroad business to so great an extent, however. The large freight bill for automobiles and parts, as well as the charges on material carried to and from the factories, makes up to a considerable extent what they take away in passengers.

AMERICAN CARS IN NORWAY.

In Norway, where German cars formerly dominated the market American cars have been becoming popular and numerous during the past few years. They are sold at prices that are from 50 to 75 per cent. lower than their German competitors, and because of their excellent performances are now about the only cars purchased. The import duty is only 12 per cent. ad valorem. The one obstacle to the growth of the trade is the demand of American makers for payment in New York City. Four-cylinder cars have previously been the most popular, but the eight-cylinder is now being taken up.

SPLITDORF SECURES CONTRACTS.

Two equipment contracts recently closed by the Splitdorf Electrical Company of Newark, N. J., are especially notable because of the diversity of purposes to which they are to be applied. One is with the Moreland Motor Truck Company, Los Angeles, for the Splitdorf commercial car equipment of Dixie-40 magnetos and Dixie-40 with A. V. S.

The other is with the Hall-Scott Motor Car Company, West Berkeley, Cal., for Dixie-60 magnetos to be used in aeroplane motors which the company will manufacture.

CHALMERS OUTPUT INCREASED.

The Chalmers Motor Company made a new record for shipments Feb. 23, when 157 cars were sent on their way. The company is now working on a regular daily schedule of 125 cars.



Knox Tractor and Special Trailer Equipment Used by French Army to Transport a 26-Foot Cannon, Weighing 20 Tons—This Machine Hauled the Gun 11 Miles, Over Poor Roads in an Hour and a Half.

Chevrolet Expects \$6,000,000 Profits.

Report for Last Third of 1915 Shows
Earnings of About
\$1,130,000.

The report of the Chevrolet Motor Company and subsidiary companies for the 4½ months ended Dec. 31, 1915, shows net earnings from operations of \$1,128,041.06 after deducting expenses. The balance of the income amounted to \$555,488.90, from which was deducted \$30,392.44 for expenses incidental to organization, leaving a net income of \$1,653,686.53 for the period. The cash position as of March 1 is given as: Cash and transit items, \$5,377,079.

The consolidated balance sheet as of Dec. 31, 1915, follows:

Assets.	
Contracts with allied companies, real estate, buildings etc.	\$13,661,590.50
Prepayment on contracts....	150,000.00
	13,811,590.50
Cash and cash items.....	4,192,968.12
Current investments.....	629,000.00
Notes receivable.....	313,048.86
Accounts receivable.....	1,018,809.08
Merchandise, material and supplies (at cost or less)...	3,288,272.03
Charges deferred to future operations.....	9,442,098.09
	30,352.47
Total.....	\$23,284,041.06
Liabilities.	
Capital stock (authorized)...	\$80,000,000.00
Less unissued.....	60,000,000.00
	20,000,000.00
Less in treasury.....	247,700.00
	19,752,300.00
Mortgages payable.....	85,000.00
Accounts payable (not due) ..	1,202,812.81
Customers' deposits.....	138,205.21
Accruals.....	103,508.14
	1,444,526.16
Depreciation—capital assets..	87,381.12
Depreciation—current assets	196,329.98
Income tax.....	20,006.75
Contingencies.....	44,810.52
	348,528.37
Surplus.....	1,653,686.53
Total.....	\$23,284,041.06
Income Account.	
Net earnings from operations, after deducting costs of manufacture and expenses of advertising, selling, administration, taxes, etc.	\$1,128,590.07
Cash discounts on goods purchased.....	64,129.93
Interest earned.....	24,434.84
Dividends received.....	2,742.84
Profit—sale of securities....	448,323.77
Miscellaneous revenue.....	15,857.52
	555,488.90
Deduct expenses incidental to organization.....	30,392.44
	525,096.46
Net income for period (4½ months).....	\$1,653,686.53
William C. Durant, president of the	

company, in his statement accompanying the report, said that since the beginning of the present fiscal year, Jan. 1, 1916, production has shown an increase of 55 per cent. over the 4½ months period. He further said:

"While materials at the moment are difficult to obtain and prices are considerably higher in some instances, the reduction in overhead expenses enables us to show a reduction in cost as compared to the period covered by the report.

"Due to abnormal conditions, as a matter of protection, we are carrying extremely large inventories, fortifying ourselves to take care of contracts and orders representing a value in excess of \$26,000,000 now upon our books for delivery within the next five months.

"The operating profits of the Chevrolet companies for the year ending Dec. 31, 1916, should approximate \$6,000,000, to which will be added the income from other sources."

CHANDLER PROFITS \$933,217.

The Chandler Motor Car Company, the old company, reported to the New York stock exchange for the year ended Dec. 31, 1915, and two previous years, as follows:

	1915	1914	1913
Gross profits.....	\$1,507,360	\$706,123	\$154,461
Other income..	101,125	43,283	13,034
Total income	\$1,608,485	\$749,406	\$167,495
Expenses.....	\$641,733	\$423,585	\$123,363
Depreciation ..	33,534	4,000	1,900
Net profits....	\$933,218	\$321,821	\$42,232

The newly organized Chandler Motor Company's balance sheet as of Jan. 1, 1916, is as follows:

Liabilities.	
Capital stock.....	\$7,000,000
Accounts payable.....	410,162
Deposits from dealers on contracts.....	63,725
Reserve for taxes and contingencies.....	14,146
Surplus.....	173,450
Total.....	\$7,661,473
Assets.	
Goodwill and organization.....	\$5,000,000
Real estate, buildings and equipment.....	223,928
Investments.....	48,240
Cash in banks and on hand.....	1,613,515
Accounts and notes receivable..	138,828
Inventories (at cost).....	622,644
Prepaid expenses.....	14,318
Total.....	\$7,661,473

Recently the Chandler Motor Company placed its stock on a basis of six per cent. per annum by declaring a quarterly dividend of six per cent. on the common.

GRANT ELECTS OFFICERS.

David A. Shaw was re-elected president of the Grant Motor Company, Findlay, O., at the recent annual meeting. George D. Grant is first vice president and George Salzman second vice president. George S. Waite was chosen secretary. The directors elected were A. E. Dorsey, James M. Howe, E. C. Edwards and R. R. Hall.

Studebaker Earnings Were Doubled in 1915.

Net Sales for the Period Were Over
\$56,000,000—Sold 46,845
Cars.

Studebaker Corporation, Detroit, shows by its report for the year ended Dec. 31, 1915, an increase in net profits over the preceding year of nearly 50 per cent. Net sales for the period amounted to \$56,539,006, as against \$43,444,223 in 1914, and net earnings of \$9,248,375 as compared with \$5,345,395. Net profits were \$9,067,425, while those of 1914 were \$4,844,663.

Cost of manufacture, selling and general expenses for the period were \$47,045,582. In 1914 they were \$37,870,999. The surplus account showed \$8,470,952, compared with \$5,265,819 for the preceding year.

President Erskine in his address to the stockholders said:

"As the sales include but \$13,000,000 last year and \$2,000,000 in 1914 from so-called war orders, the stockholders will realize that the volume of business and profits are coming from steady sources. In 1911 we sold only 22,555 automobiles, whereas last year we sold 46,845, over 90 per cent. of which were delivered to regular customers in the United States and the remainder to regular customers in export markets, excepting about 1200 cars sold to foreign governments for hospital and other purposes.

"As we made sharp reductions in the prices of our cars last summer, the increase in the volume of our automobile sales over 1914 was only 17.5 per cent., but in number of cars the increase was 32.1 per cent."

During the past year several measures were made to strengthen the financial position of the company. One of these was to discharge the entire indebtedness, except current account. Accordingly, all outstanding notes payable and maturing serial notes were paid and over \$2,000,000 serial notes maturing from 1916 to 1922 inclusive, were purchased in the open market and cancelled. Being unable to purchase the remaining serial notes, the directors on Oct. 18 exercised their option and called the balance outstanding, \$2,305,500, for payment on the first possible semi-annual interest date, namely, March 1, 1916, and also to issue and sell to stockholders 20,684 shares of common stock then held in the treasury at \$110 a share and to use the proceeds in retiring the notes. This stock was sold for \$2,324,468.40, and the amount received in excess of par was credited to surplus account.

AJAX SELLS TO EMPLOYEES.

The Ajax Rubber Company, Inc., New York City, announces that the entire block of the new issue of common stock set aside for purchase by employees under the profit sharing plan arranged by the company and Prichitt & Co., bankers, has been taken up, and that further

purchases have been made by the employees in the open market.

The plan provides for the sale of the stock to Ajax workmen at the issue price on installment payments. An initial payment of 15 per cent. is required, the balance being in monthly installments, stipulated according to the salary of the purchaser. Subscriptions were received from the company's branches in various parts of the United States.

NASH HEADS BUICK.

At the recent election of officers and directors of the Buick Motor Company and the Weston-Mott Company, Flint, Mich., both of which are subsidiaries of the General Motors Company, Charles W. Nash was chosen as president of the Buick organization, while C. S. Mott is head of Weston-Mott.

The other officers of the Buick company are: Mr. Mott, vice president; T. S. Merrill, secretary; James T. Shaw, treasurer. Floyd A. Allen is assistant to both the secretary and treasurer. L. F. Oland is controller and Mr. Nash is general manager.

H. H. Bassett is vice president of the Weston-Mott company, T. S. Merrill is secretary, James T. Shaw is treasurer and A. C. Anderson is assistant to both Merrill and Shaw. H. J. Mallory is controller and H. H. Bassett is general manager.

GOODRICH BOARD INCREASED.

At the recent annual meeting of the stockholders of the B. F. Goodrich Company the number of directors was increased from 14 to 18. The new men selected and the person chosen to fill the vacancy caused by the resignation of A. H. Wiggin are: W. O. Rutherford, A. B. Jones, Dr. W. C. Geer, H. E. Joy and H. K. Raymond.

The regular quarterly dividend of one per cent. has been declared on the common stock, payable May 15 to stock of record May 4. The authorized preferred issue was reduced from \$28,000,000 to \$27,300,000 at the stockholders' meeting.

SPLITDORF CLOSSES CONTRACTS.

The Splitdorf Electrical Company, Newark, N. J., announces that it has closed the following contracts:

Champion Auto Equipment Company, Wabash, Ind., using two-unit system complete with ammeter, Dixie 40 magneto and $\frac{3}{4}$ -inch plugs and cables.

Sure Motor Car Company, using Dixie 40 with heavy hex plugs and cable.

Hascall Motor Company, manufacturer of Hascall 1000-pound truck, using Dixie 40 magneto, spark plugs, cables and ignition switch.

PACKARD DECLARES DIVIDENDS.

The Packard Motor Car Company, Detroit, has declared the regular quarterly dividend of $1\frac{1}{4}$ per cent. on the preferred stock, payable March 15 to stock of record Feb. 29. The books do not close.

Scripps-Booth Is Enlarging Scope.

Under Presidency of C. H. Booth, Company Is Showing Great Activity.

Indicative of the large scale campaign on which the Scripps-Booth Company, Detroit, is now setting forth is the announcement that the capitalization of the company has been increased to \$1,000,000, and that Clarence H. Booth has been elected president.

Mr. Booth was formerly general manager of the automobile department of the Studebaker Corporation. When he went over to Scripps-Booth early last year the capital was increased to \$350,000 from \$100,000. It was evident from the first that in order to give scope to his marketing and production plans, a further increase was necessary. Since then the selling and manufacturing ends have been intensively developed.



Clarence H. Booth, President of Scripps-Booth Company.

William E. Scripps is vice president of the new company, which retains the old name, but is incorporated under Delaware laws. James S. Booth is secretary and F. J. Sensenbrenner is treasurer.

Of the new capital stock \$750,000 has already been subscribed and paid for, largely by the old organization. The balance is to be kept in the treasury for the present.

MAUS JOINS FISK.

John B. Maus, who for the past two years has been eastern district manager for the Batavia Rubber Company, has joined the Fisk Rubber Company of New York. He is well known in the tire industry, having started about 10 years ago as special factory representative for the Goodyear Tire and Rubber Company, following which he became New York district manager. He joined the United States Rubber Company about four years ago, remaining until 1914, when he became associated with the Batavia company.

Mr. Maus is to have charge of the export department at the general offices of the Fisk Rubber Company.

DE PALMA COMPANY.

A statement of much interest to motorists generally is that which links the name of Ralph De Palma, the celebrated racing driver, with the formation of the De Palma Manufacturing Company, a \$100,000 corporation, in which F. P. and J. B. Book, Jr., of Detroit are said to be the backers.

It is generally understood that De Palma will remain with the Packard Motor Car Company, with which he has a contract that will not expire until the end of this year.

The Book brothers are wealthy young men. Their father, the late J. B. Book, was associated with Walter E. Flanders in the latter's earlier enterprises.

GRAMLICH GOES TO THERMOID.

J. E. Gramlich, formerly engineer and superintendent for the Chase Motor Truck Company, Syracuse, N. Y., has severed that connection to become engineer for the Thermoid Rubber Company, Trenton, N. J.

Mr. Gramlich will give his attention exclusively to the development of the lately patented Thermoid-Hardy laminated disc, for which the company has exclusive American rights. He has been experimenting for the past three years with this form of drive and has gained a thorough knowledge of its possibilities.

SPRINGFIELD BODY OFFICERS.

The Springfield Body Company, successor to the Springfield Metal Body Company, Springfield, Mass., announces the following new management, which takes control immediately:

Walter L. Fry, president; E. W. McGookin, vice president; H. L. Bill, vice president; Walter Lyon, treasurer.

L. A. CHANDLER IS DEAD.

L. A. Chandler, associated with the Harding Manufacturing Company, 40 Court street, Boston, Mass., and widely known throughout the New England motor vehicle territory, died Saturday, Feb. 26.

TO BUILD FERGUS CAR HERE.

J. B. Ferguson, designer of the Irish Fergus car which was shown at the New York City show, has made arrangements to produce the car in this country. With Frank J. Bowen, formerly sales manager of the Locomobile Company of America, he has formed a company known as the Fergus Motors of America. William H. Campbell and Sydney T. Perrin represent the Americans, who are financing the scheme. Headquarters have been opened at 80 Maiden lane, New York.

Ferguson is to be permanently identified with the car in this country and for that purpose has sailed for Belfast to

complete arrangements for moving here. A factory is to be secured near New York, possibly in New Jersey, and the machine will be manufactured in small quantities at first, according to American methods, and with only such changes in design as are required for American conditions and manufacturing methods.

HATHAWAY HEADS STANLEY.

Charles E. Hathaway has resigned as Chicago manager of J. H. Williams & Co., manufacturers of drop forgings, and has been elected president of the Stanley Belting Corporation, which markets a solid woven cotton belting with a patented hinge weave that is made in Scotland and is used both for transmission and conveying purposes. Mr. Hathaway's headquarters will be in Chicago.

The vice president of the Stanley company is A. L. Whittemore, who formerly was assistant to Mr. Hathaway with the Williams organization. John Laurence was re-elected secretary, and A. G. List was chosen as treasurer.

NEW PRESIDENT FOR PYRENE.

Upon the retirement of Darwin R. James, Jr., as president of the Pyrene Manufacturing Company, New York City, C. Louis Allen, sales manager, will take the office. Mr. James is to engage in other affairs in which he is extensively interested.

Mr. Allen's rise has been meteoric. About 2½ years ago he entered the company's employ as a salesman, and five months later was made sales manager. In June 1915, he was given charge of the advertising department also. Much of the company's progress of late is generally credited to him.

TO RETIRE TIRE STOCK.

In accordance with the provisions of the certificate of incorporation, the Kelly-Springfield Tire Company, Akron, O., has set aside \$75,246 in the special surplus account, which will be expended in purchasing for retirement and cancellation the six per cent. preferred stock. Sealed written offers were to be received up to March 3. It is understood that trading in Kelly-Springfield stock on the New York stock exchange will start March 9.

TO MANAGE COLE COMPANY.

A. F. Knobloch, formerly general manager of the Northway Motor and Manufacturing Company, has been appointed to a like position with the Cole Motor Car Company, Indianapolis. His brother, W. H. Knobloch, and A. Keller, an efficiency engineer, are also recent additions.

DORT NOW \$665.

The Dort Motor Car Company, Flint, Mich., announces that the price of the Dort touring car has been increased from \$650 to \$665.

Overland Shows Income of \$10,870,678.

After Making Deductions for Dividends,
Etc., Earnings Equal 46.76 Per
Cent. on Common Stock.

The Willys-Overland Company, Toledo, O., and subsidiaries report for the year ended Dec. 31, 1915, a net income of \$10,870,678 before deducting a reserve of \$1,000,000 for contingencies. This is equivalent to 46.76 earned on the \$21,000,000 common stock after deduction of \$322,165 for preferred dividends.

The surplus left after payment of all dividends and the deduction of the contingency reserve amounted to \$7,318,618. The profit and loss surplus was reported as \$14,720,550. During the year \$250,000 was laid aside for the redemption of preferred stock.

The report for the year ended June 30, 1914, which is the latest available for comparison, shows a net income of \$5,864,858, an amount after deduction of preferred dividends equivalent to 27.57 per cent. earned on the common stock of \$20,000,000. The profit and loss surplus in June, 1914, was given as \$5,502,234.

SERVICE INCREASES CAPITAL.

The stockholders of the Service Motor Truck Company have voted to increase the capital stock from \$250,000 to \$450,000. The new issue of stock has practically all been subscribed by the present stockholders.

The company recently made two large additions to its plant, which is now nearly doubled in floor space, but it is felt that owing to the great increase in Service business more buildings will have to be erected soon.

DIRECTS PREMIER SALES.

P. S. Stubbs, lately an executive of the sales force of the Hudson Motor Company, has accepted the directorship of sales for the Premier Motor Corporation, Indianapolis. He has had exceptionally wide and valuable experience in the motor vehicle industry. As early as 1906 he was assistant sales manager of the Knox Automobile Company, Springfield, Mass., joining with John N. Willys the next year as sales manager and continuing with him in his many early successful ventures.

When the Hudson Motors reorganized its personnel in 1910, Stubbs joined the sales staff in an executive capacity, later serving as eastern manager, assistant sales manager and recently as Pacific Coast distributor.

MOTOR PARTS SERVICE.

The Motor Parts Company, 185 Columbus avenue, Boston, Mass., which is a branch of the Pennsylvania company of the same name located at 818 North Broad street, Philadelphia, and co-operates with branches at Springfield, Mass., and Buffalo, N. Y., is generally conceded

to be a distinct success as distributor of high-class special equipment for motor cars and motor boats.

The company was organized about four years ago and since then has followed a definite plan of combining direct factory service with its sales. For this purpose a staff of factory trained mechanics are always kept ready, in charge of an engineer, to assist the users of the equipment supplied by the company.

Through its agencies, which number more than 40, and with which the office of the Motor Parts Company is in constant touch, this service is carried directly to the door of the consumer throughout the territory in which the company operates. Because of this direct service the company has increased its sales of equipment until it is now solidly entrenched and is acknowledged an authority on electrical equipment.

The Motor Parts Company represents the Bosch Magneto Company, New York (starting, lighting, ignition and equipment for Ford cars); Westinghouse Electric and Manufacturing Company, Pittsburgh (equipment for Fords); Zenith Carburetor Company, Detroit (standard carburetors and equipment for Fords); A. R. Mosler & Co., Mount Vernon, N. Y. (Spitfire spark plugs); Carter Carburetor Company, St. Louis (Carter automatic gravity tanks); Kemco Electric Manufacturing Company, Cleveland (fan type generators); Nonpareil Horn Manufacturing Company, New York City (Noxal horns).

The company also distributes Leak-proof piston rings, Lynite pistons and accessories necessary to complete installations and always carries adequate stocks of all the products of the concerns mentioned, so that it is possible to obtain immediately either complete equipment or any spare parts.

The company maintains repair and installation departments for the purpose of installing such equipment as any patron might purchase if it is desired. The general guarantees issued by the manufacturers are in force in the Motor Parts Company, and there is a standing invitation to make use of its service departments.

STUDEBAKER RAISES PRICES.

Studebaker Corporation has increased the prices on its series 17 cars, the four and six-cylinder models that made their appearance just before the New York show. The increases are as follows:

	New Price	Old Price
Four-Cylinder Model		
Touring car.....	\$875	\$845
Roadster	850	825
Landau	1150	1145
	New	Old
Six-Cylinder Model		
Touring car.....	\$1085	\$1050
Roadster	1060	1025

SAXON ADVERTISING MANAGER.

R. H. Harger, formerly advertising manager for the Markham Air Rifle Company, has been appointed advertising manager for the Saxon Motor Car Company, Detroit, to succeed E. W. Corman, resigned.

THE TWO DETROITER MODELS FOR 1916.

The Latest Product, the Six-45, Is Provided with a Double Cowl Body with Luxurious Appointments—Though Essentially High-Grade, Its Price Is Only \$1098.

A CAR which sells distinctly under the high priced class and yet incorporates most of the features of those luxuri-

ous cars is being marketed by the Detroit Motor Car Company, Detroit, under the model name of the "Six-45." This machine accompanies the four-cylinder model which the company has been manufacturing for some months.

The price of the new six is \$1098. It has a double cowl streamline body of the most modern type, and is finely finished and luxuriously upholstered. It is a car intended to appeal to the desire for something distinctive, high-grade and original.

The motor is a six-cylinder unit power plant with $3\frac{1}{4}$ by $4\frac{1}{2}$ cylinders cast en bloc. It develops 25.35 horsepower, according to the S. A. E. rating. The cylinder heads are detachable, valves are enclosed and the lubrication is accomplished by a constant level splash system maintained by a plunger pump. The motor is made by the Continental Motor Company and is its new "little six," high speed, L head type. The carburetor is a Ball make.

Starting and Lighting System.

The car is equipped with a two-unit starting and lighting system of the Auto-Lite make. The distribution is accomplished by the Connecticut system with a unit separate from the generator. It operates on the variable spark principle. Ignition is by battery.

The clutch is a dry multiple disc construction and the plates are faced with Raybestos. The transmission is the conventional three-speed forward and reverse gear box, which operates on the sliding gear principle.

Three-fourths floating is the description applied to the rear axle which carries most but not all of the car weight on the housing.

A large ball bearing carries the differential, while roller bearings are used for the wheels. The gears are of the spiral bevel type to insure quiet running.

Wheels are of the artillery type and

five demountable rims are supplied with them. These are equipped with 33 by four-inch tires, non-skids at the rear.

The frame is a pressed channel section of $4\frac{1}{2}$ -inch depth and is especially shaped at the rear for the extra long semi-elliptic spring. The front axle is the usual "I" beam drop forged and especially heat treated.

The rear springs, of the semi-elliptic type, are specially long, being $52\frac{1}{2}$ inches and $2\frac{1}{4}$ inches wide. They are slung under the rear axle. The Hotchkiss drive conveys power through these members, which are of vanadium steel.

The service brake is external contracting on rear wheel drums, while the emergency brake is internal expanding on the same.

A steering gear of the irreversible worm type is employed. The wheel is of wood and notched and is 17 inches in diameter. The control is of the centre ball type. The driver sits on the left side.

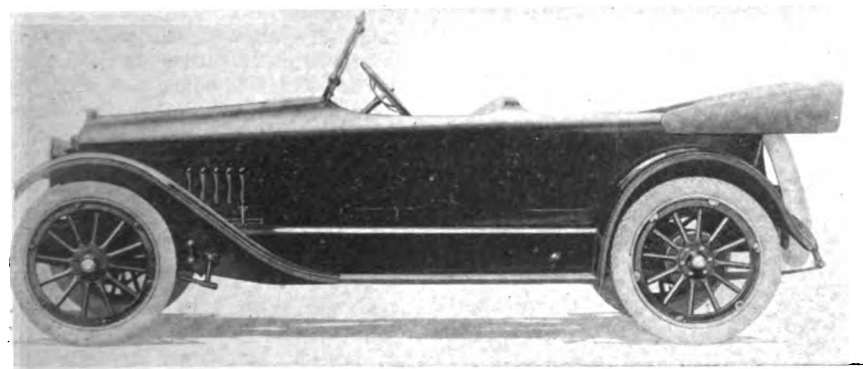
Vacuum Gasoline Feed.

Gasoline is carried in a tank under the body at the rear and is fed to the carburetor by vacuum. The capacity is approximately 18 gallons.

The five-passenger touring car body is fitted with an especially wide and roomy tonneau. In fact, the company puts much emphasis on the statement that there is more room in the body and more comfort is possible in it than in any other car made in the United States which does not sell for a higher price.

The body is hung exceptionally low to secure a low centre of gravity and achieve the much coveted low-hung lines. No similar body has previously been produced by the Detroit Motor Car Company.

Upholstering is of genuine machine buffed leather and is very deep and soft. The top is a one-man type with side curtains. The windshield is of the clear vision type and is set at such an angle that it is tilted back slightly to afford the utmost comfort and ease of vision. It adds greatly to appearance of the car.



The Detroit Model Six-45, Which Is Priced at \$1098.

FEATURES OF THE NEW DETROITER SIX-45.

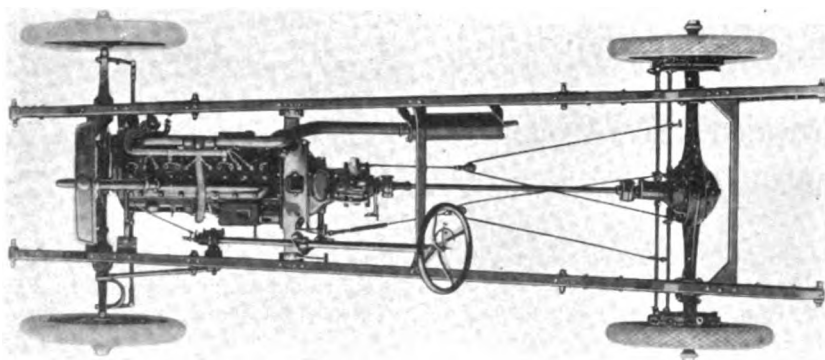
Make of Motor.....	Continental
Shape and Cast.....	L-En Bloc
Cylinders	Six
Bore and Stroke.....	$3\frac{1}{4} \times 4\frac{1}{2}$
S. A. E. Rating.....	25.35
Piston Displacement..	223.95 Cu. In.
Cooling System.....	Pump
Lubrication	Splash
Ignition	Battery
Carburetor	Ball
Lighting-Starting	Auto-Lite
Clutch	Disc
Gearset.....	Selective, Three
Wheelbase	118
Wheels	Wood
Rear Springs.....	$\frac{1}{2}$ Elliptic
Steering and Control..	Left Centre
Rear Axle.....	Floating

Price.

Touring, Five-Passenger.....	\$1098
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The Detroit Four-Cylinder Model, Selling at \$885.



Chassis of the Six-45, Which Has Low Centre of Gravity.

Other equipment includes a Stewart speedometer, gasoline gauge, robe and foot rails, electric headlight with dimming attachments, dash light, oil pressure gauge, rotary electric horn, pump, jack, tire repair kit and tools.

The four-cylinder Detroit car is known as the model F. With five-passenger touring body it is priced at \$985. The cylinders are $3\frac{3}{4}$ -inch bore by $4\frac{1}{4}$ -inch stroke and are cast en bloc. The valves are on the left side of the L head. There is one crankshaft carried in the crank case, and it is driven by silent chain. The three main crankshaft bearings are lined with babbit.

The cooling system is a thermo-syphon type, and ignition is drawn from a Dixie magneto. A single set of plugs is used and the spark is controlled by hand. Lubrication is effected by a straight splash system, which is fed and kept at constant level by a plunger pump.

A Schebler carburetor atomizes the gasoline and it draws its fuel by gravity from a tank in the cowl. The Dyneto single unit starting and lighting system is employed. It works at 12 volts. The generator-motor is driven by chain.

Disc Clutch in Oil.

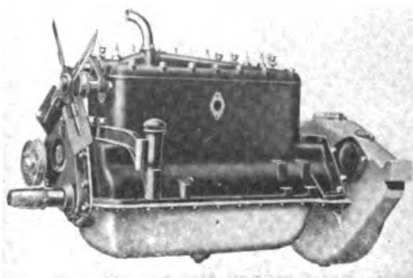
The clutch is a disc that runs in oil, and the gear set is a selective sliding type with three speeds forward and reverse. It is located in unit with the remainder of the power plant.

The rear axle is full floating with a gear ratio of 49 to 12. The bevel gears are helically cut. Hotchkiss drive directs the propulsion through the springs. Wheelbase is 112 inches and tires are 33 by four inches. The front springs are of the semi-elliptic type, while those in the rear are platform.

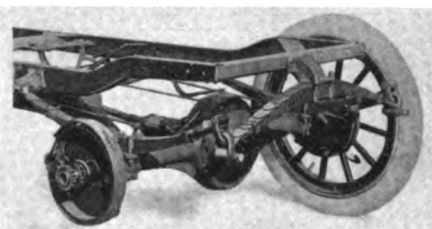
The steering wheel is on the left side and the gear controls are in the centre of the front compartment.

There are two sets of brakes, both operating on double drums, which are fully enclosed. Both are internal expanding, the service brake being 14 inches in effective diameter and the emergency 10 inches. Both are $1\frac{1}{2}$ inches wide.

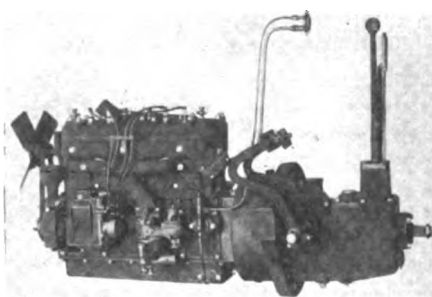
Equipment consists of one-man top, dust boot, side curtains, rain vision windshield, speedometer, instrument light, emergency lamp, cigar lighter, horn, headlights with dimmers, tail light, non-skid tires in the rear, straight side demountable rims, tire irons, tool kit, robe and foot rails.



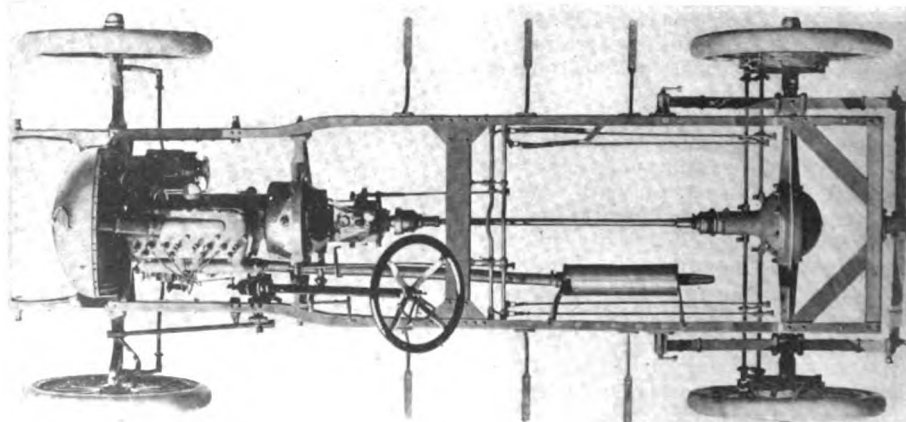
Continental Motor Used in the Six-45.



Spring Assembly of Model F.



Motor of the Model F.



Chassis of the Four-Cylinder Model, an Exceptionally Sturdy Construction.

The car is exceptionally large, roomy and comfortable, and weighs only 2400 pounds. The body doors are 24 inches wide. The model is more than ordinarily luxurious for a light car and it has many special features that will be attractive to most owners.

SELL CARS IN SPITE OF TAX.

In spite of the duty of 33 $\frac{1}{3}$ per cent. on passenger cars collected by the British government, American makers are still selling cars in considerable number in England although for the month immediately following the imposition of the tax there was a falling off in the imports.

The English board of trade returns show that in September the number of complete cars imported was 2661, with a value of \$2,519,771, and the following month this fell to 1806, valued at \$1,622,515. The figures for October are, however, very much greater than for the same month of 1914, when the imports were 336 cars and the value \$460,663. In October, 1913, 1119 cars, valued at \$1,232,855, were imported, which shows that at present shipments are greater than they were under normal conditions.

These figures, however, include both passenger cars, which pay duty, and commercial cars, which do not, and the falling off may be chiefly in the kind of cars that pay duty. Parts, tires and gasoline imports have increased rather than decreased.

TRAVELLERS PREFER MOTORS.

The extent to which the development of the motor car has effected the passenger earnings of the railroads is shown in figures of such traffic in and out of the Boston railway terminals.

The number of persons using North station, where the Boston & Maine enters, reached a peak in 1912, and in the three succeeding years there have been decreases of 5.89 per cent., 4.07 per cent and 2.93 per cent. respectively. Even greater losses are shown by the New Haven and the Boston & Albany roads at South station. In 1915, as compared with 1914, the Boston & Albany lost 6.83 per cent. The New Haven figures show a loss of 2.58 per cent. in 1914 as compared with 1913, and a loss of 4.34 in 1915 as compared with 1914.

HOW FEDERAL ROAD MONEY IS TO BE DISTRIBUTED.

General Survey of the Activities and the Phases of Highway Construction and Maintenance, with Alphabetical List of Federal Road Appropriations and Plan of Distribution.

The \$25,000,000 appropriated by the federal government to aid the construction of roads in those states, paying to the extent of from 30 to 50 per cent. of the total cost, is to be divided as follows: Each state will receive \$65,000, provided it meets the requirements; one-half of the remaining money will be distributed on the basis of population and the remaining half according to the mileage of post roads in the state.

Under this arrangement the states will share in the fund as follows:

Alabama	\$579,180
Arizona	117,512
Arkansas	430,396
California	504,788
Colorado	253,168
Connecticut	258,638
Delaware	103,290
Florida	220,348
Georgia	722,494
Idaho	170,024
Illinois	1,372,330
Indiana	854,868
Iowa	841,740
Kansas	747,656
Kentucky	580,274
Louisiana	345,064
Maine	276,142
Maryland	318,808
Massachusetts	535,420
Michigan	850,492
Minnesota	733,434
Mississippi	497,130
Missouri	974,114
Montana	192,998
Nebraska	514,634
Nevada	101,102
New Hampshire	175,494
New Jersey	438,054
New Mexico	155,802
New York	1,594,412
North Carolina	655,760
North Dakota	325,372
Ohio	1,198,384
Oklahoma	532,138
Oregon	248,792
Pennsylvania	1,469,696
Rhode Island	139,392
South Carolina	442,430
South Dakota	337,406
Tennessee	694,050
Texas	1,070,386
Utah	143,768
Vermont	187,528
Virginia	591,214
Washington	301,304
West Virginia	340,688
Wisconsin	736,716
Wyoming	125,170

It is estimated that the states without government aid last year spent \$235,000,000 on the roads in construction, and with maintenance included, about \$260,000,000. Consequently, the federal appropriation will not add so greatly to the present rates of expenditures.

HOW THE ROADS WERE LAID OUT.

An investigation of the origin of our main travelled highways and the way in which they came to be laid out has convinced Virgil D. Allen, a civil engineer and amateur archeologist, that most of them were in use before the white man came to America. They were used by the Indians and before them, in many cases, by the mound builders.

There are evidences even that some of the first roads followed the game trails which had been used for countless years in the migrations of animals, even before man inhabited the continent.

While it is the tradition that the Indian roamed about the forests without compass and never got lost, Mr. Allen is convinced that he was as much dependent on the trails and paths of his time as the white man is today upon his roads.

While Indian villages moved from place to place the same sites were used repeatedly by the same tribe of Indians and by others. These sites were selected because of their strategic situation with regard to trails and paths and water supply. They usually contained a plot of cleared land which the women cultivated.

The paths they used, he finds, can be divided into general trails, from east to west; portages from the head waters of one stream to those of another, going in an opposite direction; hunting paths that usually lead along the banks of streams; and war paths that lead from one tribal territory to another.

The logic on which these paths were laid out often seems to recognize the principles which engineers today regard as sound. Ridges were favored because they were more free from water at all seasons of the year. Being dryer they were immune from rank undergrowth, they afforded a good view of the surrounding country, and were kept clear of snow by the sweep of the winds.

Circuits were usually made around hills. Swamps were avoided and fords placed on the streams where the banks were high and dry. Many of these ford locations have since become excellent sites for bridges.

The Indians marked these trails by cutting bark from the side of the tree and these marks often conveyed much information as to the number of campfires distant were certain points, as well as the direction. Information regarding enemies was conveyed in the same way.

Prehistoric men were often better road locaters than their civilized successors in Mr. Allen's opinion. In some localities there are two systems of roads, one the old Indian trails improved and the other a system of rectangular roads following the boundaries of townships and sections. In most cases of this kind the heavier traffic still clings to the prehistoric roads.

THE APACHE TRAIL.

A new highway, 120 miles long and built at a cost of \$350,000, has been constructed recently through Arizona, touching at many spots of great interest to tourists. It will be travelled this summer by thousands. Already a number of motor car lines are operating over it and are carrying passengers for hire.

The road opens up territory that was formerly considered as impenetrable. It is known as the Apache trail and runs from Globe to Phoenix, passing the Roosevelt dam and the homes of the cliff dwellers. A line of seven-passenger cars is already travelling the road.

OFFERS TOURISTS AID.

With the approach of spring and the touring season thousands of motorists in all parts of the country are planning long summer trips. To aid them in selecting the best routes to various places the American Automobile Association has as-

Poster Designed by Coles Phillips, One of America's Leading Artists, for the Willys-Overland Company's Campaign That Will Cover a Showing in Approximately 3500 Cities in the United States and Canada.

sembled at its bureaus in Washington, in the Riggs building, and at 437 Fifth avenue, New York City, vast quantities of road data which have been contributed by automobile clubs in all parts of the country. Tourists are invited to correspond with the bureau when such information is desired.

NEW JERSEY ROADS.

Orders from Europe for munitions overwhelmed the powder works at Penn's Grove, Salem county, N. J., and brought a sudden boom in population to that community. Many lawless characters arrived and the county jail was soon overcrowded.

A road camp of prisoners was organized and has been in operation for some time to take care of the surplus of convicts. It is composed of two clean buildings mounted on wheels. The food is good and the accommodations excellent. The guards eat the same food as the men, sleep under the same conditions, and the two men in charge of the gang in the day time do exactly the same work as the others.

Fines are worked off at the rate of 50 cents a day. Men with families are not fined. They serve longer sentences and the 50 cents is paid to their families. When they have finished their sentences they are said to find no difficulty in getting work from the farmers and usually are much improved in health and physical condition.

This camp was organized to meet an unusual situation. Its success may lead to the adoption of the scheme by those counties all over the country who usually keep their short time prisoners idle. Kalamazoo county, Michigan, recently started a similar system.

PERMANENT ROADS FAVORED.

There is a growing tendency among road builders to put down the most substantial and durable surface on improved roads rather than gravel or macadam, which has been popular in the past. New York state towns and counties last year let contracts for 200 miles of concrete roads and by the end of the year 110 miles of these had been completed. It is probable that this year the amount authorized will be much larger.

Highway authorities everywhere are realizing that it is more satisfactory and economical to build roads that will stand up for many years under changing traffic conditions than it is to put down types that cost less but which can only be expected to last for a few years.

KANSAS WORKS PRISONERS.

Kansas has arranged to work its convicts on the roads under a plan that is very liberal to the men. Every prisoner who works faithfully will receive a commutation of one day from his sentence for every three days he works. The town for which the work is done will pay \$1 a day for the work of each prisoner. Half of this will be used to feed, clothe and

care for the man and the other half will be paid to his family or will be held in reserve for him when he completes his sentence.

This plan, which has been developed by Warden J. K. Coddington of the Kansas state prison, who has just been reappointed and approved by the legislature, is looked upon as sure to secure the cooperation of the prisoners.

CONVICTS IN ARIZONA.

After three years' experience Arizona officials are enthusiastic over the system of building roads and bridges by convict labor. They find that it improves the health and builds up the character of the men and that the roads constructed are better than those built by day labor.

Governor Hunt declares the reason for this to be that the convicts do the same sort of work day after day until they become rather expert at it, while day laborers seldom remain long enough at the work to acquire the same skill. In camps where guards have to be employed the cost of construction by the convict system is about the same per yard as by free labor, but in camps where honor men work without guards the cost is much lower.

PENNSYLVANIA TOLL ROADS.

There are still over 100 miles of toll roads within 20 miles of the city of Philadelphia, according to a survey by the city's automobile club and a campaign is under way to have the state, townships and counties take over these roads.

The Lancaster pike for a considerable distance from Philadelphia is to be made a state highway, but it seems probable that the smaller political divisions will have to take over most of the roads.

The charges collected for the use of these roads amount to about four cents a mile, though in some cases they are as much as 4 1/3 cents. The condition of the roads varies from fair to bad, but none of them are good, according to the report.

OPPOSE ROADS BILL.

Some motorists, especially those interested in long distance touring routes, are objecting to certain features of the Shackelford bill, which appropriates \$25,000,000 a year for federal aid to state road improvement. This bill provides for the improvement of post roads. That means roads that are or might be used for rural mail delivery.

They are selected by the secretary of agriculture and in all likelihood will be chosen with a view to providing the greatest benefit to farmers and townspeople in the locality, rather than with the idea of connecting up roads for long distance touring or for improving such highways as the Lincoln or Dixie routes in their entirety.

The motorists who desire that done urge the government to link up its road work with the "preparedness" pro-

gramme and build the roads to transport armies from one part of the country to the other. This, of course, would make them excellent touring highways. There is every probability, however, that the farmers' interests will be considered first in the matter.

FARMERS AND GOOD ROADS.

There are 6,500,000 farmers in the United States and most of them raise something for market, according to the American Highway Association. The roads which they use are largely unimproved—2,000,000 miles of them are unsurfaced. The cost of hauling over such roads averages 23 cents a ton mile, while the cost of hauling over surfaced roads is 13 cents a ton mile. The farmers lose \$300,000,000 through poor roads.

Farmers are characterized by Dr. T. N. Carver of Hartford university as an individualistic, headstrong class, who are very difficult to organize and this unwillingness to act together is responsible largely for the poor roads and for the other characteristic evils of rural life.

Where good roads exist, according to recent studies made of the subject, they have had the effect of building up large schools, which are much better than those small isolated ones in many country districts. The churches are stronger and every form of social life is better developed and performs its functions more usefully in those sections which have good roads.

In places where the highways are bad the churches are slowly dying, the schools are poor and the evils of isolation which lead in some cases even to insanity and suicide are acute. Good roads greatly increase the value of the farm land and by reducing hauling cost on supplies and distribution cost on products greatly increase the farmer's prosperity.

FEDERAL REGISTRATION.

Numerous congressmen have expressed their approval of the Adamson bill, which provides that the owner of a motor car can go to any state in the Union with it without additional taxation after he has paid his own taxes. Scores of other statesmen have promised it careful and conscientious consideration.

Its reception by Congress has proved to be very different than that given a similar measure put forward several years ago. At that time automobiles were much more expensive than now and there were only about 100,000 in the country. Now there are two and a half million and another million may soon be added.

The fact that farmers have been buying cars in great numbers has brought a new and considerable political ally to the aid of the motor car and there are predictions that before many years special motor car taxes will be abolished and that the machine will be taxed precisely as is any other piece of property.

PRACTICAL SUGGESTIONS FOR MOTOR CAR OWNERS.

Hints That Make For Economical Maintenance and Operation of Motor Vehicles, and How to Construct Practical Tools and Equipment at Home at Minimum Cost.

WATER CONNECTION.

Frequently the rubber hose used to connect the lower opening of the radiator

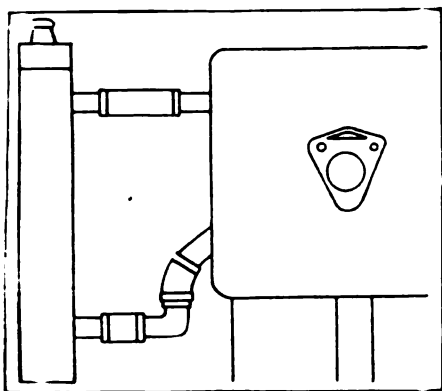


Fig. 148—Pipe Elbow Will Afford Free Water Circulation—Rubber Hose Has Tendency to Kink.

tor to the opening in the cylinder will become kinked and the free circulation of the water will be impeded. Many methods for remedying this condition have from time to time been explained in these columns. In Fig. 149 is shown a method suggested by a subscriber.

A short rubber hose is fastened to the lower pipe of the radiator and a second short length to the water intake pipe of the cylinder jacket. The two are then joined by a small iron elbow, such as is ordinarily used for making piping connections.

STEERING WHEEL PULLER.

In Fig. 150 is shown a tool of simple construction for removing the steering wheel in a workmanlike manner. It consists of a piece of steel 18 inches long, one inch wide and a half inch thick. In the centre of this bar drill and tap a hole to receive a half-inch screw. The necessary bends to be made are shown at A. The end of the screw inserted in the centre hole should be filed to a point. At B is shown how the tool is applied to the steering wheel.

PAINTING THE CAR.

Painting the body of a car is ordinarily a task which only the expert can satisfactorily perform. But there are numerous occasions, notably when no striping is to be done, when the owner can do the work himself and save quite a sum of money. The following suggestions apply to such cases.

As bodies are now made, the largest part is of metal, and for such it is advisable that paint adapted to metal surfaces should be used. This is because metal contracts and expands according to the

changes in temperature. Ordinary wood paint would crack and peel.

The old paint must be removed before applying the new, and it can best be done by burning it off with a blow torch. However, if the owner is not proficient in handling such equipment it is best that he use a prepared paint remover.

Wash the body thoroughly to remove all dirt and grease and when dry apply the paint remover with a brush. This will soften the paint, which then can be scraped off easily with a putty knife. Next wash the metal with gasoline and when dry sandpaper carefully to produce a smooth, bright surface.

In painting it is first necessary to apply a "primer," which seals the surface against moisture, etc., and also provides a purchase for the coat of paint. The primer should be allowed to dry for about 48 hours and all cracks should be filled with glazers' putty and allowed to harden.

Next smooth the surface of the primer with No. 0 sandpaper, after which the body is ready to receive the first coat of

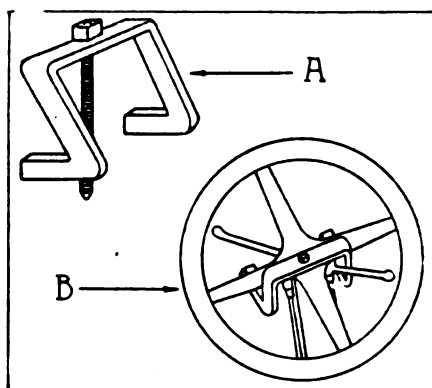


Fig. 150—A, Easily Constructed Tool for Pulling Steering Wheel; B, Method of Application.

color, which can be purchased prepared for immediate use. This should be applied with a camel's hair brush and allowed to stand for at least 24 hours. Rub this coat, a section at a time, with a handful of black curled hair until the roughness and high spots have been removed. The surface will be much scratched, but this is desirable because it tends to allow the finishing coats to knit with the first.

The next two coats to be applied are of rubbing varnish, allowing a period of 48 hours to elapse between each application. Now comes the rubbing operation, which should be done with a piece of felt saturated with a mixture of No. 0 or 00 pulverized pumice and water.

This is the stage of operation when patience and practise is most desirable. Rubbing, or surfacing, varnish is an art. Experts always rub in one direction and

lengthwise of the panel. The pressure at first is light, and then it is gradually increased. Keep the surface well wetted all the time to prevent the pumice from scratching. When an even surface is obtained, wash the body thoroughly to remove the pumice and other foreign substances.

The body is now ready for the last or finishing coat, which should be of hard drying varnish. Use badger hair or Thumbs' bristle brushes to apply all varnish coats. This last should be allowed to stand for at least a week before disturbing. Before using it is advisable to rinse the body several times with clear, cold water.

Of course the owner should be governed in following the preceding suggestions by the conditions he must meet. They apply to the majority of cases, but in some they should be changed to meet the requirements.

One thing should be borne in mind, and that is that the work should be done in a room or garage where the temperature can be kept constant at all times during the work.

HOME-MADE LAMP BRACKETS.

In Fig. 151 is illustrated a lamp bracket which can be attached to the car easily and without machine work, and it can be adjusted to eliminate light glare.

The bracket consists of two suitable lengths of round cold roll stock threaded at the lower ends. By clamping in a vise the metal can be bent to form the step shown at A. From a bar of steel, one inch square, saw off two pieces that are two inches greater in length than the width of the car frame. Clearance holes should be drilled near the ends of these so that the threaded ends of the bracket pieces can be inserted. A few nuts and washers complete the equipment.

The method of mounting on the car is

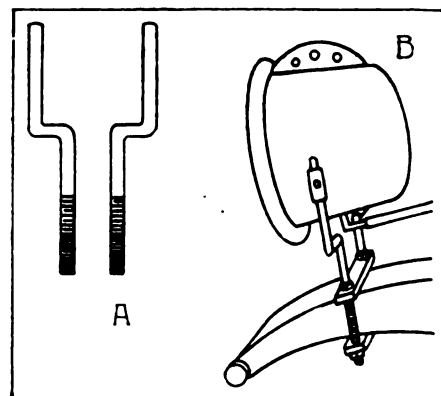


Fig. 151—A, Formation of Lamp Bracket; B, Showing Attachment to the Frame Horn so as to Cast All Light Downwards.

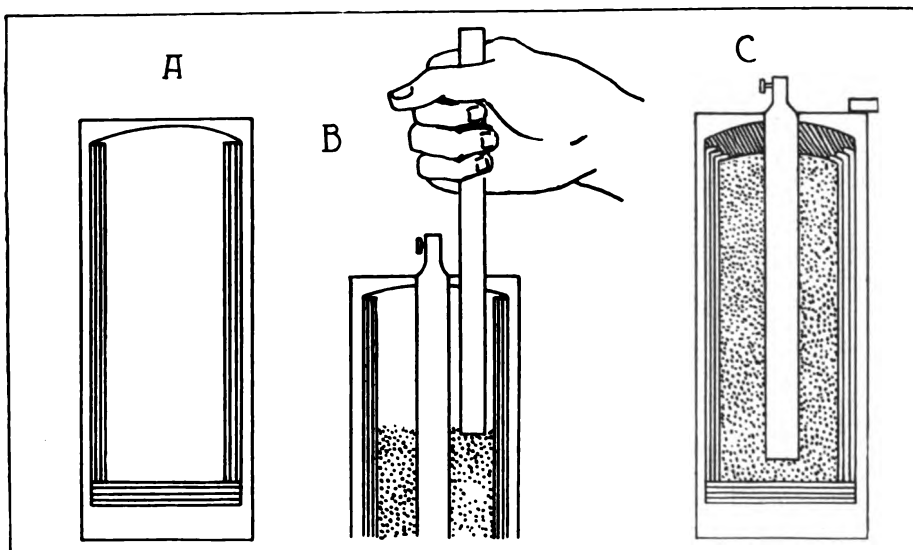


Fig. 152—A, Arrangement of Blotting Paper in Zinc Shell; B, Tamping Down Filler; C, Fully Constructed Dry Cell.

shown at B. Two nuts are first threaded onto the bracket pieces, which are then passed through the holes in the short bars. By fitting washers and nuts on the threads at the base of the bracket pieces the bracket can be adjusted at any desired angle on the frame.

It is obvious that this arrangement will allow the headlight to be tilted so that the light rays will be cast downward. Of course brackets should be made for both headlights.

BUILDING A DRY CELL.

It generally is false economy to build or reconstruct a dry cell. The cost of the materials needed, added to the cost of the labor involved, is almost equal to that of a new cell. However, if it is necessary that one make his own cell, the following will be found helpful:

Dig out all but the zinc shell of a worn out cell, and clean this shell thoroughly. Line it with white blotting paper, as shown in Fig. 152. Place circular pieces at the bottom, and then three or four thicknesses at the sides. Do not use glue in making the paper fit snugly to the zinc. If necessary use stationers' clips.

Saturate the blotting paper with a solution of zinc chloride and sal ammoniac dissolved in distilled water. The zinc chloride should be dissolved first in the water, until a hydrometer shows a reading of about 32 degrees, and then the powdered sal ammoniac should be added.

The filler generally used in dry cells consists of two parts of powdered manganese and three parts powdered carbon or coke. Carbon has been found to give the better results, but is much more costly than coke. Mix the two powders thoroughly and dampen with the same solution in which the blotting paper has been immersed.

Drop the filler into the cylinder a small portion at a time. When the lining at the bottom has been slightly covered by the filler, place the carbon rod—the old one may be used, if desired—in the centre of the cylinder and then pack in the filler solidly. Use a small tamping stick, such as is shown in Fig. 152 B for this

purpose. Fill to within a half inch of the top and then fold in the blotting paper and seal with wax. The battery is now ready for service. The complete cell is shown at C.

PATCHING OIL WICKS.

The pleasure of night driving is often nullified through one of the oil lamps failing to burn properly. In the case that the wick is too short to reach into the oil the trouble can be overcome by attaching a small piece of waste to the one in the lamp by binding the two together with a rubber band. The oil will pass readily through the waste and thence to the wick.

MOVING A HEAVY LOAD.

During a recent heavy snowfall in Boston, Mass., many of the teaming companies did their hauling by sleighs instead of wagons, but because the city workmen had removed most of the snow from the main thoroughfares, a large sleigh, drawn by four horses and laden

with approximately six tons of raw wool, became stalled while attempting to cross one of these streets. Other teamsters offered assistance, but their horses could not obtain the required footing. A large five-ton truck, which had arrived in the meantime, was hitched to the load. Although it was equipped with non-skid chains, the rear wheels simply spun on the ice.

In Fig. 153 is illustrated the method suggested by a bystander and which moved the load with ease. One end of a stout rope was tied to the base of a convenient telegraph pole and the other end to the rear wheel of the truck. A chuck was also placed in front and behind this wheel. One end of a long chain was secured to the other rear wheel of the vehicle in the manner shown and the other to the pole of the sleigh. A rope was also attached to the front of the truck and to another post, as shown. By jacking the wheel having the chain attached and operating the truck in low gear, the chain was wound around the rear wheel and the sleigh was easily drawn from the main highway.

PROTECTING CABLES

Usually when the hood of a car of an early make is raised, one is confronted by a complex wiring arrangement. The ignition cables are exposed to the action of water and oil, and in time the insulation material rots and causes short circuits. This condition can be remedied at trifling expense, as illustrated in Fig. 154.

From a discarded garden hose, cut a good section of sufficient length to extend from the front of the motor to the front dashboard. The secondary wires leading from the induction coil should be threaded through the hose. By cutting small holes in the hose at points opposite the spark plugs in the cylinders, the ends of the cables can be drawn out so that plug connections can be made. The hose can be retained over the motor in a horizontal position by small metal brackets.

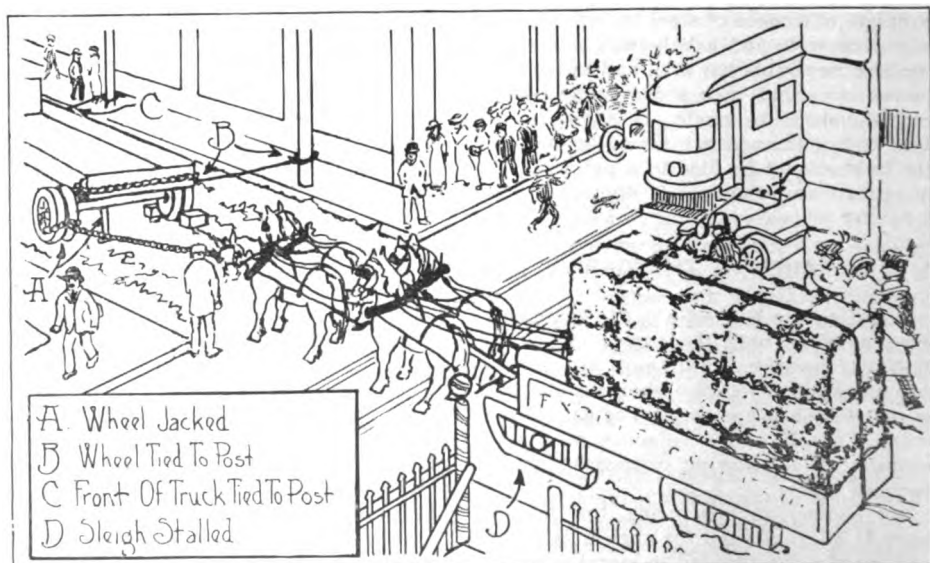


Fig. 153—Method of Harnessing a Truck on a Slippery Surface to Pull a Heavily Laden Sleigh Stalled on a Dry Surface.

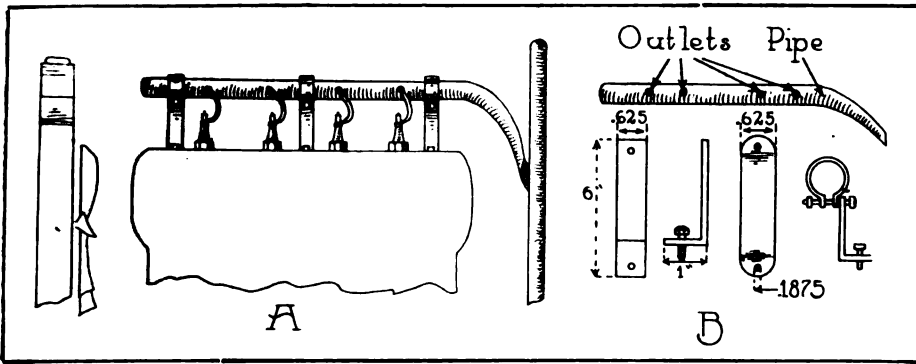


Fig. 154—A, Economical Method of Protecting Ignition Cable; B, the Materials and the Required Shapes for the Device.

The brackets consist of pieces of sheet steel or brass, six inches in length and $\frac{5}{8}$ of an inch in width. Near the ends of the metal, two $\frac{3}{16}$ of an inch holes should be drilled. Next measure a distance of one inch from the end of the metal and at that point bend it to a right angle.

The next step is to cut and drill a similar number of metal pieces in the same manner as described. Round corners of these with a file and then bend the pieces so that a perfect circle is formed. The ends can then be bent down so that a bolt can be passed through the holes.

These brackets can be secured to the motor by any convenient cylinder head bolts. If necessary, small holes can be drilled and tapped in the cylinder heads.

At A is shown the manner of attaching the arrangement to the car, while at B the parts needed and their forms are illustrated. When fully assembled, as shown at A, a cork can be placed in the front end of the hose so that water cannot enter through this opening.

PREVENTING FREEZING OF SYSTEM.

Many owners of commercial and pleasure vehicles store their cars in barns or unheated sheds. If a well proportioned anti-freezing solution is used in the water of the cooling system, ordinarily no damage from freezing will be done. However, starting will be difficult. In Fig. 156 is illustrated the method used by one truck owner who stores his vehicle

in an unheated building. He places an electric light under the hood and covers the front with heavy wraps. The heat thrown off by the light maintains an even temperature about the engine and prevents congealing of the oil, freezing of the water, etc. The cost of the electric current consumed is trifling and there is no danger of fire.

CAR SIGNS.

Many merchants use their pleasure cars for business purposes and some

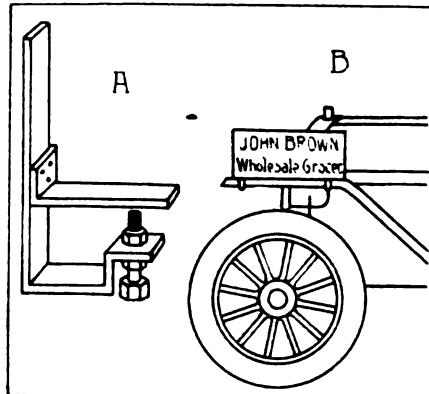


Fig. 155—A, Construction of Bracket for Retaining Sign to Fender; B, Sign Attached to Car.

paint small advertising signs on the panels. One disadvantage of this practice is that whenever the car is used strictly for pleasure, it is made unduly

conspicuous by the sign. In Fig. 155 is shown the method adopted by a wholesale grocery dealer to overcome this undesirable feature.

It consists of a small wooden sign clamped to the front mudguards by two brackets. The type of bracket used is illustrated at A. They are made from a bar of steel which is one inch wide and $\frac{5}{8}$ of an inch thick. The bar is shaped like the letter Z and at one end a hole is drilled and tapped to receive a $\frac{1}{2}$ -inch set screw. A small brace, which is placed across the top of the guard, should be similarly shaped and riveted to the bar. The sign can, of course, be bolted to the top of the bracket.

A small strip of leather should be placed at the top and side of the mudguard so that the metal bracket will not scratch the paint. A view of the sign attached to the car is shown at B, and indicates how easy it is to remove the sign by loosening the two set screws under the mudguard.

LOCKING THE CAR.

Many accidents have resulted from children and curious persons releasing the emergency brake in the absence of the operator. On several cars, especially trucks, this condition can be avoided, as shown in Fig. 156. The emergency brake lever is first set to the desired position and a small hole drilled through the lever guide and in front of the lever. A small padlock is inserted through the guide. It is then impossible for anyone to release the lever or operate the car without first removing the lock. Many times it is not necessary to drill the guide if a padlock can be obtained that will fit in the notch as shown at A. These methods are simple, yet effective and inexpensive. The same principle often applies to locking the gear shifting lever.

When grinding valves it is often almost impossible to turn the valve caps. A simple remedy which will prevent a recurrence of this condition is to coat the threads of the caps with graphite when replacing them. Graphite will prevent compression leaking by the threads.

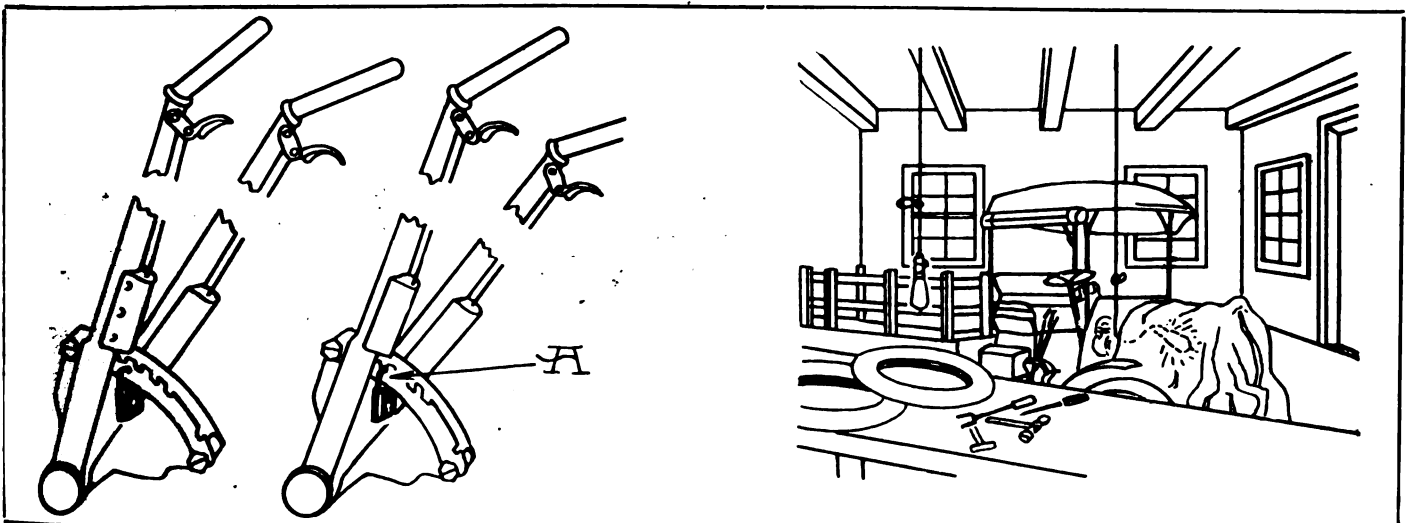


Fig 156—Using Padlocks to Secure Emergency Brake Lever in Locked Position (at Left); Electric Light and Heavy Wraps Prevent Freezing of Cooling System in Unheated Garage.

NEWS OF THE AUTOMOBILE SHOWS.

Both Syracuse and Indianapolis Report Great Successes at their Annual Exhibitions of Motor Vehicles.

Dealers and manufacturers generally judge the health of the motor vehicle industry in upper New York state by the success of the Syracuse automobile show. The dealers in that city dominate a territory in which reside about 650,000 people, the most of whom this year are feeling the effects of a return to prosperity. This was evident in the attendance and the sales at the eighth annual exhibition that has just closed and is announced as an unqualified success. Last year this section absorbed more than 20,000 cars. According to the results of the show, it is freely predicted that this number will be exceeded in 1916 by at least 25 per cent.

The show was held in the infantry and cavalry armories, and was staged by the Syracuse Automobile Dealers' Association, of which H. T. Gardner is acting secretary and general manager. It was essentially a dealers' exhibition, and during the week approximately 250 distributors of that section were present. The average of daily attendance was reported as 5000, and the cars on display included the majority of the leading makes. Six motor trucks were shown.

INDIANAPOLIS' BIG SHOW.

The motor vehicle dealers of Indianapolis and neighboring towns were highly gratified by the results of Indianapolis' annual automobile exposition, which was held in the Coliseum at the state fair grounds from Feb. 28 to March 4. This building afforded good possibilities in the way of decorations, and the show management spent about \$10,000 in making the best of the opportunities. The general scheme was a reproduction of a Jap-

anese park, which was the work of the artist Tietzel. Cherry trees, monumental gates and quaint towers and pagodas predominated.

There were 55 exhibitors of pleasure cars, which included the leading makes seen at the national shows, and there were eight commercial vehicles shown. In the accessory division the exhibits numbered 25.

THE TASMANIAN SHOW.

American machinery of all sorts, including motor cars and motorcycles, and a farm tractor, were shown at the Southern Tasmanian agricultural and pastoral show, which was held recently at Hobart, Tasmania. Sales were large and representatives of American motor car makers in most cases disposed of their stocks and placed additional orders. One make, recently introduced, sold four cars, all that were included in the initial shipment.

A demonstration of the farm tractor was made to show its economy in comparison with horses and it convinced the Tasmanian farmers of its superiority. American cars and motorcycles are very popular in this market.

RED BANK TO HAVE SHOW.

An automobile show to represent the county of Monmouth, N. J., is to be opened in the new state armory at Red Bank on March 14, and is to be continued until the evening of the 18th. This is according to an announcement made by C. H. Packer, secretary of the show management.

COMING EVENTS IN MOTORDOM.

March.

March 14-18—Show, Red Bank, N. J.
March 15-18—Show, Trenton, N. J.
March 21-25—Show, Deadwood, S. D.
March 22-25—Show, Saginaw, Mich.
March 27-April 1—Show, Zanesville, O.
March 28-April 3—Show, Manchester, N. H.

April.

April 8—Race, Corona, Cal.
April 10-15—Show, Seattle, Wash.
April 15—Convention, Pennsylvania Motor Federation, Altoona, Penn.
April 24-29—Show, Bangor, Me.
April 26-May 6—Show, Oakland, Cal.

May.

May 6—Race, Sioux City, Ia.; speedway.
May 13—Race, New York City; Sheepshead Bay speedway.
May 30—Race, Indianapolis; speedway.
May 31—Race, Minneapolis; speedway.

June.

June 10—Race, Chicago, Ill.; speedway.
June 28—Race, Des Moines, Ia.; speedway.

July.

July 2-6—Convention, World's Salesmanship Congress, Detroit, Mich.
July 4—Race, Minneapolis, Minn.; 300-mile speedway.
July 4—Race, Coeur D'Alene, Idaho.
July 15—Race, Omaha, Neb.; speedway.

August.

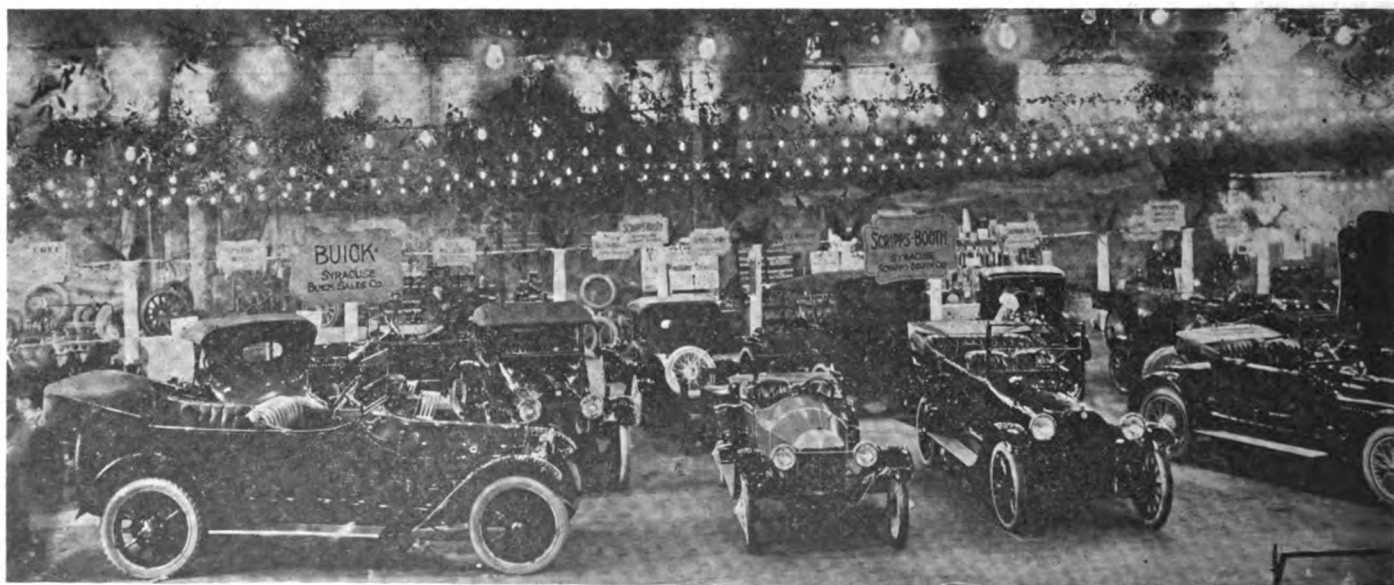
Aug. 5—Race, Tacoma; speedway.
Aug. 18-19—Race, Elgin, Ill.; road.

September.

Sept. 4—Race, Indianapolis; speedway.
Sept. 4—Race, Des Moines; speedway.
Sept. 16—Race, Providence; speedway.
Sept. 30—Race, New York City; Sheepshead Bay speedway.

October.

Oct. 7—Race, Omaha, Neb.; speedway.
Oct. 14—Race, Chicago, Ill.; speedway.
Oct. 19—Race, Indianapolis, Ind.; speedway.



View of the Syracuse Exhibition, Showing the Effective Decorative Scheme and Some of the Pleasure Car Exhibits Which Attracted Much Attention.

A. L. A. TESTS MASSACHUSETTS REGISTRATION LAW.

Effort Being Made to Defeat Excessive Taxation—Other News of Legal Matters which Effect Owners and Operators of Motor Cars In Various Parts of the Country.

The Automobile Legal Association is testing by legal processes, the Massachusetts registration law. An attorney representing the association drove an unregistered car on the streets. He was arrested, convicted and fined and is appealing the case as rapidly as possible to the supreme court on the ground that the law is unconstitutional.

The registration law was declared constitutional in 1905, but at that time the fees collected were only \$2, to cover the expense of registration. Since then they have been increased. Motorists have been willing to pay, because the money was used for the improvement of the roads, but they held the amount by which the fee exceeded the cost of registration to be a special tax and as such to be unjustifiable.

There is an increasing tendency to increase the rates and in an effort to stamp out this form of taxation the case has been begun.

FOUR NEW JERSEY BILLS.

Four bills affecting motorists have been introduced into the New Jersey legislature. One prohibits the use of muffler cut-outs anywhere in the state; the second provides that the registration certificate for any car shall be carried by the owner; a third permits the commissioner of motor vehicles, or any salaried inspector, to make a complaint on information of an infraction of the vehicle laws within a year of the time the offense is committed, instead of 30 days; and the fourth requires every motor vehicle driver to make a report to the commissioner of any accident his car may have figured in.

BILL AGAINST INTOXICATION.

The Massachusetts House of Representatives has passed a bill which will considerably increase the penalties imposed on intoxicated and reckless automobile drivers, though they are not so severe as those proposed in the Sawyer bill, for which it is a substitute.

The resolution kills the proposals of exacting triple damages in civil suits for such accidents and removes the 10 to 20 years imprisonment provision. Under the provisions a minimum fine of \$20 is imposed for running an automobile recklessly or while under the influence of liquor. The law revokes the license of the driver on the first conviction, and it cannot be renewed for two years, and, in case of a second conviction, in five years.

In favoring this bill the house overruled the committee on roads and bridges, the highway commission, and opposed the representations of the vari-

ous automobile associations which favored the retention of the present law.

URGES TRAFFIC BOARD.

The Safety First Society has recommended the establishment in New York City by legislation of a traffic board to consist of William McAdoo, chief magistrate; Arthur Woods, police commissioner, and George H. Bell, commissioner of licenses. The board would have jurisdiction of such matters as the suspension or revocation of licenses of all owners or operators of motor vehicles, as well as motorcycles and horse drawn vehicles.

UNIFORM TRAFFIC CODE.

A uniform code of traffic rules, approved by the Chiefs of Police Union for adoption by every community in Massachusetts, has been drawn up and submitted to all the city and town authorities in the state. The code was drafted by the Highway Safety League, after consultation with Chairman Sohler of the Highway Commission, Secretary O'Callahan of the Boston Street Commission, and the national traffic committee of the Safety First Federation of America. The fact that it was drawn at the request of the chiefs of police and was later endorsed by them will practically assure its adoption in the various towns.

The code contains one provision that is not now in use in any city or town. This provides that all fast moving vehicles, except when overtaken by faster moving ones, shall keep away from the curb and keep in the centre of the travelled way.

Another requirement is that no vehicle shall stop within 10 feet of a fire hydrant or a marked pole of the trolley system, except when directed by the traffic police. The provision of the Boston code which permits the police to control pe-

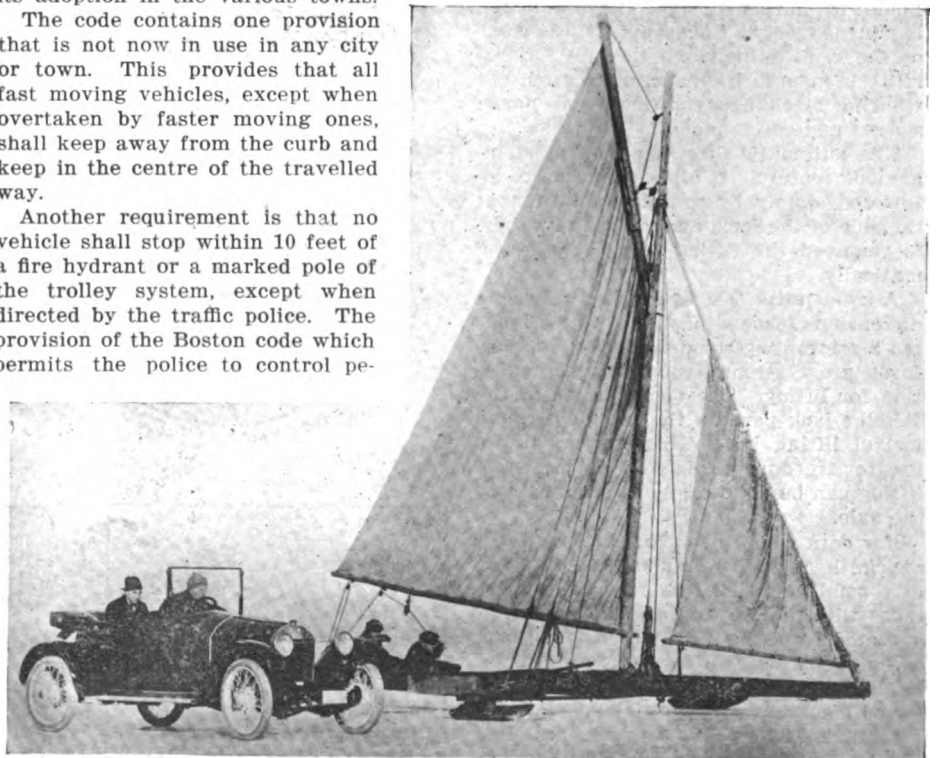
destrian traffic by signal is incorporated.

Regulations depending on local conditions are not included, but can be added in the form of one or two special regulations by the various towns.

KILL AUTO BILLS IN SENATE.

The committee on roads and bridges of the Massachusetts state senate has reported adversely on a number of bills for the regulation of motor cars. One of these was a bill to require designation of safe cross walks in cities. Another bill disapproved was for more inspectors of automobile accidents and suspension for one year of an operator's license for operating under the influence of liquor. Another bill to suspend a license for two years on conviction of reckless driving was "killed."

A bill has been introduced into the New York state legislature to the effect that one-half of every county's contribution to the fund made up of automobile registration fees be returned to that county with the restriction that it be used for highway improvement. This will mean about \$1,000,000 a year will be so distributed. It is a part of the agitation to secure for New York City a larger portion of the benefit derived from the taxes it pays.



Scripps-Booth Races with an Ice Yacht on Lake St. Clair, Near Detroit, and Through Its Ability to Run in the Face of the Wind, It Made a Very Creditable Showing—The Driver of the Car Was Henry Woodall.

MOTOR CAR ACCESSORIES AND EQUIPMENT.

BEAN VALVE TOOLS.

Better results with less labor can be obtained when valve grinding if Bean refacing and reseating tools are first used to remove the carbon and the unevenness of the valves and valve seats. A glance at the valve refacing tool, shown on this page, will instantly communicate to the workman the great saving of labor which is afforded by its use. It is a reversible frame, supporting at one end a disc for grinding, and at the other end a disc with spiral cutters for tooling. The adjustable bushings provided are adapted to reduction in the size of valve stem caused by wear, thus insuring perfect alignment.

The Bean reseating tool consists of a cutter, a pilot and a cutter handle with lock nut. The cutters are made in various sizes and are of the finest steel, tempered and accurately ground. This method insures the trueness of the valve and its seat, and allows accurate grinding to be done in the shortest time possible. This equipment is of great value to any repair shop as it will increase the grade of work produced. It is also valuable to car owners.

Manufactured by the Bean Company, First avenue, Berea, O. Prices will be sent to inquirers.

PETELER JACK.

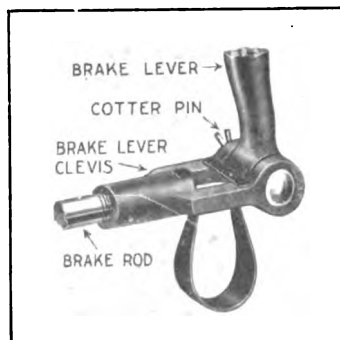
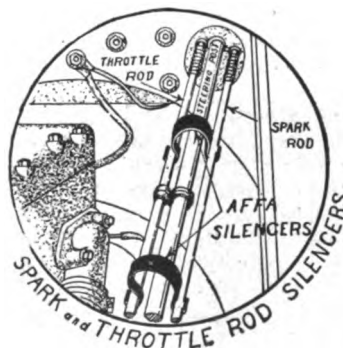
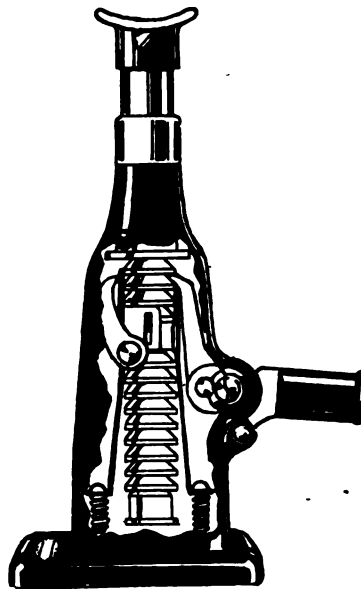
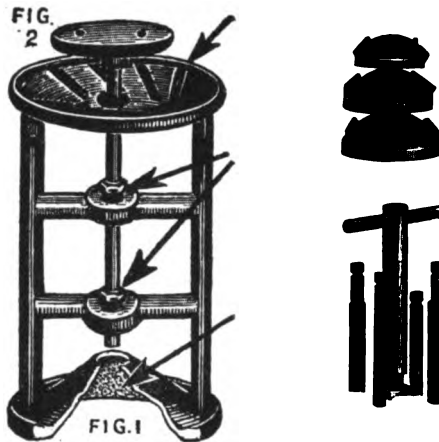
The Peteler auto jack, a sectional view of which is shown in the accompanying illustration, is designed to operate in the easiest manner possible. The pawls are made of hardened steel and the lifting bar turns freely. Consequently, the wear on the steps is distributed evenly. Durability is insured by the absence from the working mechanism of cast iron parts, screws and cotter pins.

The automatic drop bar is a most ingenious feature. It allows the car to be lowered simply by pressing a button at the side of the jack, and when the weight is removed the lifting bar drops automatically.

A solid pressed steel shell of generous dimensions forms a base into which is fitted a reinforcing wooden block, which affords great strength and ample foundation for lifting. The construction of the Peteler jack permits the use of a round swivel lifting bar. This design allows greater freedom in placing the jack, and lifting can be done easily at any angle to the axle.

For cars which have low hung axles a special head with a low step is provided at a small additional charge. This head turns with the bar and can, therefore, be operated from the side, which is a great advantage when it is necessary to lift the car by the hub. The jack is finished in baked black enamel and nickel.

Marketed by Moreau & Pratt, Inc., New York City. List price \$3.50, when equipped with the regular head, and \$4 with the special head. Complete details supplied on request.



TWO AFFA SILENCERS.

The Affa clevis silencer is a small spring designed to be inserted into the clevises at the ends of the brake rods on Ford and other cars. Its use will eliminate all brake rod rattling when the pins become worn. It is made of the finest spring steel, specially tempered and finished in black enamel. By using only a pair of pliers it can be attached to the car in a few minutes. When properly installed further attention is unnecessary.

The Affa spark and throttle rod silencers stop the rattle of those control rods which run down along the steering post under the hood of the Ford car. They are small, stiff, tempered springs, which can be snapped into place without the aid of tools. Both devices are fully guaranteed.

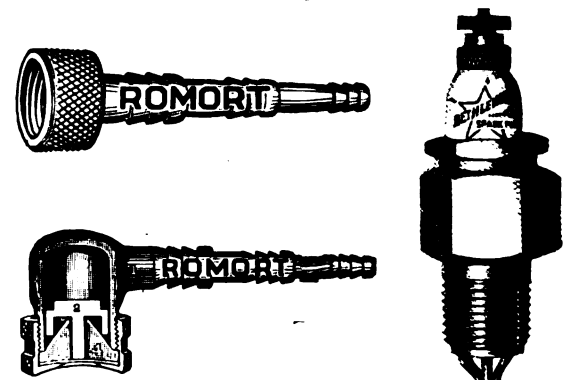
Manufactured by W. S. Graffam, 85-C Locust street, Northampton, Mass. List price of clevis silencer, 45 cents, postpaid; the spark and throttle rod silencers, 25 cents per set, postpaid.

ROMORT SPECIALTIES.

Romort specialties include those for the automobile, motorcycle, tire repair men and for the automobile world generally. The Romort automatic air valve, style B, a sectional view of which is shown herewith, is a solid bronze one-piece casting, having a universal stem, which fits any size air tubing. It is automatic in opening and closing and is guaranteed to be positively air tight. This type is strongly recommended for use in private and public garages, tire repair shops, etc., where the service does not require the use of a heavy valve. All parts are interchangeable and are carried in stock by most dealers. Each valve is equipped with the Romort pump connection rubber, which is noted for its wearing qualities.

The Romort tank or pipe end connection shown in the illustration is a brass union with a step up stem to fit any size hose. It is made to fit one-half inch iron pipe and contains a leather washer, which is not disturbed by the removal or dropping of the union. The surface of the union is knurled so it can be operated by hand. Both specialties are guaranteed to be perfect in material and workmanship and any defective part will be replaced free of charge.

Manufactured by the Romort Manufac-



turing Company, 1810 Westlake avenue, Seattle, Wash., and 1322-1326 Michigan avenue, Chicago, Ill. List price, \$1 each for the style B, automatic air valve; 60 cents each for the tank connection. Write for descriptive literature.

FIVE-POINT SPARK PLUG.

The type "K" Bethlehem five-point spark plug shown in the accompanying illustration is constructed to stand up under all conditions in heavy duty work. It is designed especially for service in motor trucks, motor boats, aeroplanes, etc. The massive construction allows the use of a very heavy and practically unbreakable insulator. The plug can be obtained with either porcelain or mica insulation. The porcelain type is made in two sizes, $\frac{1}{2}$ -inch Standard and $\frac{3}{8}$ -inch A. L. A. M.; the mica plug is made in three sizes, $\frac{1}{2}$ -inch Standard, $\frac{3}{8}$ -inch A. L. A. M. and metric.

Manufactured by the Silvex Company, 171 Madison avenue, New York City. The plug is listed at \$1.50 and carries the usual Bethlehem guarantee—"for the life of the motor."

BARRETT STARTER.

The Barrett standard starter, illustrated herewith, is designed to be used on Ford and other cars. Its principal characteristic is simplicity; there are no parts requiring oil, no friction, no bearings and absolutely nothing to get out of order or break. Provision is made for an automatic release in case of backfire.

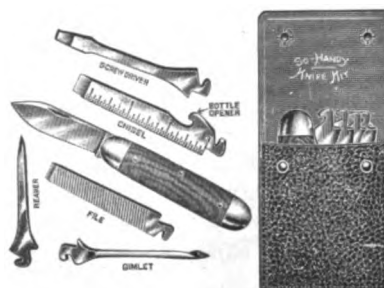
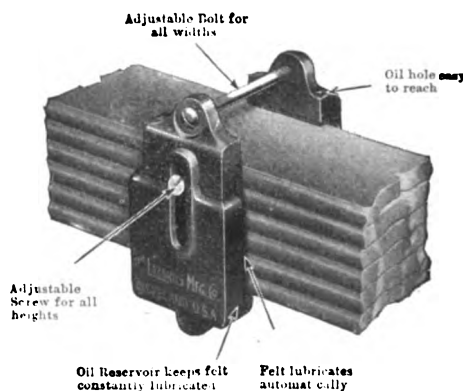
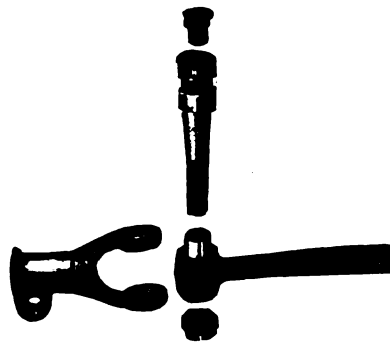
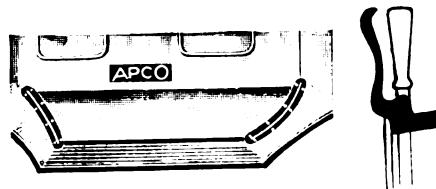
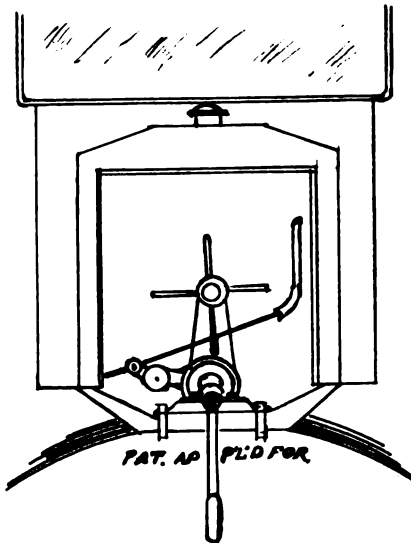
The working parts of the apparatus do not connect with any moving part of the engine, consequently, there can be no wear. It is operated from the seat. High efficiency is based on the skillful design, careful workmanship and the use of only the best of materials. Statement is made that any inexperienced person can install and adjust this starter to any car.

Manufactured by the Barrett Standard Starter Company, 1777 Broadway, New York City. Full information, price, etc., supplied upon request.

APCO SPECIALTIES.

The Apco line of specialties for Ford cars has recently been increased by the addition of a fender brace and emergency brake lever handle. The fender brace, shown herewith, is designed to be fitted between the fender and the apron, completely filling the space. Not only is the rattling of the fenders eliminated, but the splashing of water, mud, etc., on the surface of the running board is prevented. Being constructed of heavy pressed steel, the brace adds considerably to the strength of the fender and practically produces a solid construction. They are sold in sets of four, are attached by screws and can be fitted in a few minutes.

The Apco emergency brake handle replaces the original part. It is sturdy in construction and positive in its action. It is guaranteed to prevent the lever from slipping and allowing the clutch to en-



gage when cranking the car. The handle is ornamental in design and finished in black enamel. It can be fitted in a few minutes.

Manufactured by the Auto Parts Company, Providence, R. I. List price of the Apco fender brace, 50 cents per set of four; emergency brake handle, 60 cents each.

ANTI-RATTLER BOLT.

The Eclipse anti-rattler bolt, illustrated herewith, is designed to eliminate rattle and keep the steering wheel of the Ford car tight by removing the play in the tie rod yoke and spindle arm connection. It consists of a split sleeve having a cylindrical exterior and a tapered interior, through which passes a bolt correspondingly tapered. This bolt can be inserted as far as necessary, so that the split sleeve can be expanded sufficiently to snugly fit the hole, and be secured at the bottom by a lock nut. Any wear is compensated for by screwing the tapered bolt further into the split sleeve. An oil cup is fitted to the top. Attachment to the car is simple, the only tool required being a wrench.

Manufactured by the Eclipse Machine Company, Elmira, N. Y. List price, \$1 per pair.

ADJUSTABLE OILER.

The Lazco adjustable spring lubricator shown herewith will fit all sizes of springs, from those on a Ford car to the largest truck. It is adjustable to both height and width.

Spring manufacturers state that approximately 80 per cent. of spring trouble is caused by lack of lubrication. The Lazco lubricators remedy this condition by permitting oil to be gradually and thoroughly worked in between the spring leaves. Friction is eliminated, rust prevented and the danger of spring breakage minimized.

Manufactured by the Lazarus Manufacturing Company, 746 Euclid avenue, Cleveland, O. List price, 50 cents each; a set of four for Ford cars, \$2; and a set of 10 for other makes, \$5.

POCKET KNIFE TOOL KIT.

The So Handy pocket knife tool kit, shown in the accompanying illustration, is a practical and serviceable outfit that is useful in several ways.

This outfit includes a jack knife having a cocoa handle and an exceptionally good blade. The remainder of the set consists of a file, chisel, reamer, screw driver, bottle opener, gimlet and rule. These can be instantly attached to the knife handle. All are made of high-grade steel, carefully hardened and oil tempered. The complete outfit weighs but five ounces and may be conveniently carried in the pocket of the operator or in the car.

Manufactured by the Bridgeport Hardware Manufacturing Corporation, Bridgeport, Conn. Complete information may be obtained from the company.

SUGGESTIONS FOR THE FORD CAR OWNER.

Partially Disassembling the Transmission Gearset and Removing the Plates and the Disc Drum of the Direct Drive or High Speed Clutch.

The 43rd article dealing with the operation, construction, maintenance, care and repair of the model T Ford chassis is the fourth of the series devoted to adjustment, restoration and overhauling.

AFTER the engine block has been removed from the base and placed outside of the chassis the work of disassembling the unit may be begun. There are several reasons why it should be disassembled in part, at least, rather than doing work on one group and restoring this, one after another, until completion, and chief among these is the necessity of learning to what

be considerably lessened by taking the engine apart directly upon removal.

Blocking Necessary on the Bench.

The crankshaft bearings, which project below the edges of the engine block, will necessitate blocking it between the end and the centre journals, unless a frame is used so that it will set squarely, and even then the crankshaft cannot be turned when the block is standing upright, because there is not room for the crank throws. If the engine block is turned bottom up the valves and piston heads cannot be reached. Not only this, the magneto field and transmission gearset, which project at the rear of and below the block, make the work of handling the unit extremely awkward.

With a barrel the magneto field can be so placed that the edge of the barrel does not contact with it, and with blocks beneath the base flange of the engine block it can be worked on conveniently during the disassembling, which ought to be begun with the transmission gearset.

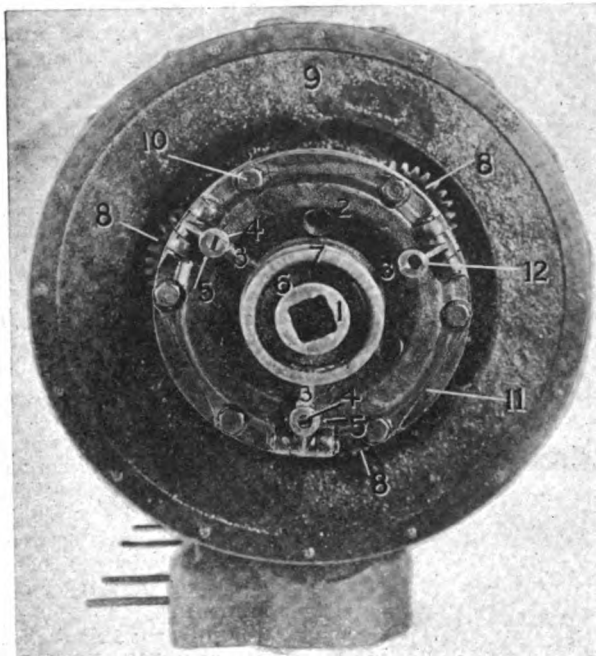
Examination of Transmission Gearset.

The gearset is a substantial construction, in every way adequate for the purposes for which it was designed and is used, and it is sufficiently lubricated to minimize wear. But it is constantly in service and after a period of use there is the best of reason for at least an examination of the assembly. If the owner were experienced with the general results from service with Ford model T chassis he might be able to judge something of the condition of the gearset by its operation and after several tests that can be made. These will be referred to in the consideration of the gearset and the work that will be necessary in connection with it. A review of the construction of the gearset may be desirable for making clear just what may be found in the overhauling.

The flywheel, which is bolted to the flange of the crankshaft, has mounted on it on the forward side the series of 16 V-shaped magnets, which are retained by 16 separate cap screws at the vertex of the magnets, and the magnet ends are secured by a series of thin bronze plates, each covering a positive and a negative magnet pole, these plates being held by brass screws that extend through the flywheel close to the periphery.

How the Gearset Is Assembled.

On the back side of the flywheel is a short stub shaft that is known as the transmission shaft. The back side of the flywheel is recessed for a considerable part of the surface area, and three studs are anchored in the flywheel in a triangular form about the transmission shaft. These are known as the triple gear shafts, or pins. The

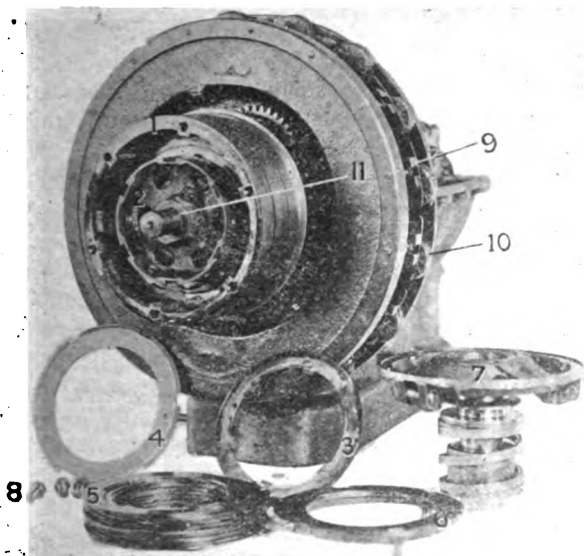


Rear End of Engine, Showing Transmission Gearset Assembly.

- | | |
|--|--|
| 1—End of Driving Plate Sleeve. | 7—Clutch Spring Support Ring. |
| 2—Driving Plate. | 8—Triple Gears. |
| 3—Clutch Fingers. | 9—Flywheel. |
| 4—Clutch Finger Adjusting Screws. | 10—Driving Plate Cap Screws. |
| 5—Clutch Finger Adjusting Screw Cotter Pins. | 11—Driving Plate Cap Screw Lock Wire. |
| 6—Clutch Spring Support. | 12—Socket for Clutch Finger Adjusting Screw. |

extent the different parts have been worn. In the event that these must be ordered time must be taken to obtain them, and until these have been received but little more than cleaning can be undertaken. After the components have been cleaned and examined a list of what is needed can be ordered, and this will expedite the work not a little so far as time is concerned.

Another reason, and what is of considerable importance, is that the engine block will be considerably lightened, and as it must be handled frequently to do the different work, the labor can



Transmission with Clutch Disassembled.

- | | |
|----------------------------------|-------------------------------|
| 1—Brake Drum. | 6—Clutch Push Ring. |
| 2—Disc Drum. | 7—Driving Plate and Assembly. |
| 3—Master Disc or Distance Plate. | 8—Driving Plate Screws. |
| 4—External Driven Clutch Plate. | 9—Magnet Magnets. |
| 5—Internal Driven Clutch Plate. | 10—Magnet Field Colls. |
| | 11—Disc Drum Set Screw. |

triple gears are spur type, having three series of teeth. When assembled the gears are placed on the pins, with the intermediate size of teeth toward the flywheel, so that the smallest series of teeth are outward. The largest series of teeth are always in the centre.

The three drums through which the gearset is controlled are in reality substantial spiders with wide rims that are each carried on a sleeve. These sleeves telescope and are mounted on the transmission shaft. The inner sleeve carries the brake drum at the rear end, the middle or intermediate sleeve carries the slow or low speed drum at the rear end, and the outer or reverse drum carries the drum at the rear end. These drums are secured to the sleeves by series of stout rivets. Each sleeve is fitted with a bronze bushing. The ends of the sleeves project through the drums when they are assembled.

Each Sleeve Carries a Gear.

The ends of the outer and intermediate sleeves are cut with teeth to form spur gears, but the end of the inner sleeve is cut with a keyway to secure what is known as the driven gear, so that, when the sleeves are assembled there is at the forward end of the unit what is in effect a triple gear, with faces that are intermediate, small and large when noted from the forward or outward end toward the drums.

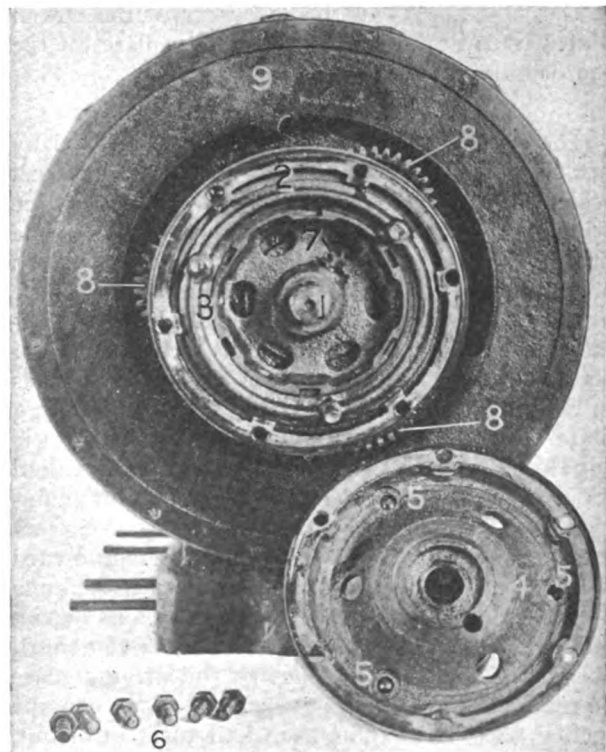
These gears mesh with the faces of the triple gears mounted on the triple gear pins of the flywheel. The inner sleeve will revolve on the transmission shaft and the intermediate and the outer sleeves will similarly revolve, according to the operating requirement. The drums and the gears make one unit of the gearset when assembled and when the assembly is placed on the

transmission shaft the end of this shaft will project through the sleeve and beyond the edges of the recess of the brake drum.

The Multiple Disc Clutch.

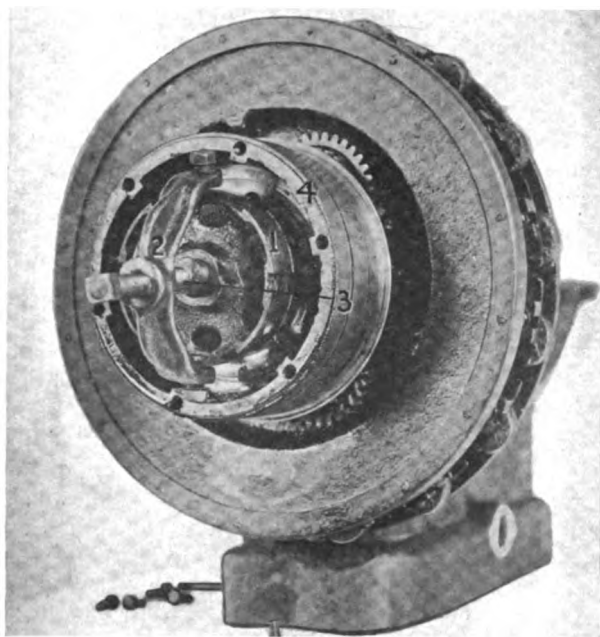
The multiple disc clutch is contained within the recess in the brake drum, and this consists of 26 thin tempered steel plates or discs. The inner circumference of the brake drum is machined so that it has six tongues or splines that project inward toward the centre. These have square edges and are equi-distant about the circumference. On the end of the transmission shaft is secured the clutch disc drum, so-called, which is a spider with a sleeve that fits on the shaft, with the circumference of the drum extending nearly even with the rear edge of the brake drum. This clutch disc drum is secured by a key that will prevent it revolving on the shaft, and there is also a set screw that is "spotted" so that the drum may be located with reference to precise position, the screw contacting with what is known as a "spot" on the shaft.

This spider has on its outer circumference six ribs or splines. The clutch discs are placed in the space between the brake drum and the clutch disc drum, the inner or bottom disc being a plate known as a distance plate or master disc that is about three times the thickness of the other discs. This distance plate has notches in its inner circumference which fit the ribs or splines of the



Transmission Gearset with Driving Plate and Sleeve Removed.

- | | |
|----------------------------------|--------------------------------------|
| 1—End of Transmission Shaft. | 5—Sockets for Push Ring Studs. |
| 2—Brake Drum. | 6—Transmission Driving Plate Screws. |
| 3—Clutch Push Ring. | 7—Disc Drum Set Screw. |
| 4—Reverse Side of Driving Plate. | 8—Triple Gears. |
| | 9—Flywheel. |



Removing Disc Drum from Transmission Shaft with Puller.

- 1—Disc Drum. 3—Transmission Shaft.
2—Disc Drum Puller. 4—Brake Drum.

disc drum, and next to this is placed a thin plate that is similarly notched. Then the plates are assembled, alternately fitting their notches to the splines of the brake drum and the clutch disc drum, until the entire number have been placed in the recess. When the assembly of the clutch plates is made there will be a large plate on the top or outside.

How the Clutch Is Engaged.

The clutch plates are engaged or released by pressure upon the clutch push ring, so-called, which is a somewhat heavier disc that has three studs equi-distant around its circumference. The driving plate is a flange secured to a sleeve with a round bore at the flange end and a square bore at the other—the rear end—and this flange is attached to the rim of the brake drum by a series of six cap screws. The flange is drilled with holes in which are seated the studs of the driving plate. At either side of these holes and at the edge of the flange is a lug, and these are drilled for pins on which are mounted three clutch fingers, one between each pair of lugs. The fingers are pivoted at one end, and are carried toward the centre, crossing and contacting with the ends of the studs of the clutch push ring which project through the driving plate. The movement of these fingers with reference to the driving plate is regulated by adjusting screws that can be locked with cotter pins each half turn, in or out, these screws contacting with the studs.

On the sleeve and against the fingers is a collar in which is a double circumferential groove or channel, which is known as the clutch shift, and is what could be termed a clutch collar. Against this collar is placed a strong helical spring of square section and but few convolutions. Within

the outer end of the spring, and against it, is set the clutch spring support, which is the seat to sustain the pressure of the spring when compressed, and outside of this is the clutch spring thrust ring, which is retained by a pin.

No Need for Complete Disassembling.

In process of overhauling there is seldom if ever need to remove the clutch shift, clutch spring, clutch spring support and clutch spring thrust ring from the driving plate. As a matter of fact there is little reason for wear to develop, for the clutch shift has large bearing on the sleeve and the movement is comparatively small. No other part is changed. The pressure exerted upon the driving plate compresses the discs of the clutch, but there is very slight motion of the fingers on the pins and considerable area of the fingers and clutch shift contact. The clutch release ring or fork, which is pivoted on the clutch lever, fits into the clutch shift from above and it is large and does not wear.

If the owner cares to do so he can disassemble the driving plate unit, but there is no need for attention other than cleaning. When the parts are removed this leaves the driving plate and sleeve bolted to the brake drum. In the illustration the driving plate and its assembly have been taken off intact. In the event that complete disassembling is desired the clutch spring thrust ring pin is driven out of the sleeve, and this releases the thrust ring, the spring support, the spring and the clutch shift, which can be drawn off the sleeve.

Removing the Clutch Assembly.

The six screws that retain the driving plate to the brake drum are locked in pairs with wire. The wire should be cut and the screws taken out, which will expose the driving plate. The third illustration shows the driving plate removed, and reversed, and the clutch push ring seated



Removing Disc Drum from Transmission Shaft Without Puller.

- 1—Screw Driver. 3—Brake Drum.
2—Hammer. 4—Disc Drum.

against the assembly of clutch discs in the clutch case. After the ring has been taken out the clutch discs can be loosened and they can be easily worked from the case with a screw driver or knife blade. This will leave the clutch disc drum, which is keyed on and secured to the shaft by a set screw, so it can be conveniently worked on.

To remove the clutch disc drum the set screw must first be taken out. Then the drum can be drawn off the transmission shaft end with a puller, a special tool for this work being made by the Ford Motor Company, which is extremely useful and saves considerable labor in the event of the drum being tightly fitted. The fourth illustration shows the tool fitted to the clutch drum ready for being manipulated with a wrench. This tool is adjustable and can be fitted with the fingers and tightened with a small wrench.

What to Do Without a Puller.

In the event that a puller is not available, however, the drum can be worked off by placing a stout screw driver in one of the holes in the sides, in which the yoke screws of the puller are seated when it is used, and pressure can be exerted upon this, while the end of the transmission shaft is tapped sharply with a lead or copper hammer. The drum can be worked off the shaft and without difficulty if one is patient, although more time would be required then when a puller is used.

The final illustration of this group shows the disc drum removed, with the set screw beside it, and the key is left in the keyway of the shaft to show its proportions. By noting the disc drum closely one will see the keyway in the centre bore.

The flange of the brake drum may be noted in the illustration surrounding the transmission shaft, and in this is a series of six holes. These are partly included in what appears to be a circular recess in the flange. This recess is worn into the metal by the master disc or distance ring, which contacted with it, and is a result of slipping the clutch. This particular brake drum is so much worn that replacement is essential, for the metal is so diminished that the distance ring will not hold on the disc drum, and the plate will fall between it and the brake drum flange. The result will be a groaning noise when the car is driven that can seemingly be traced to any part, and is exceedingly difficult to locate. Sometimes the bronze bushing, which can be noted surrounding the transmission shaft, will be found to be considerably worn and this ought to be replaced.

(To Be Continued.)

MOTOR CARS IN GREECE.

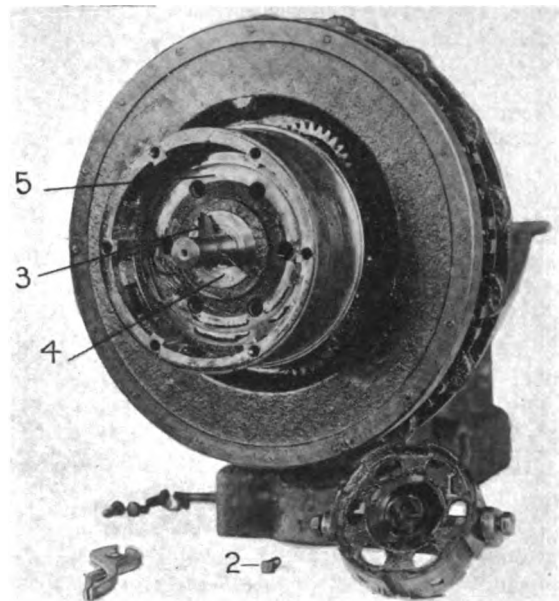
There are at present only six motor cars in use in the Grecian city of Patras, the business capital of its district and a community of 40,000 popula-

tion. Four of these are pleasure cars, and two are second-hand motor trucks which are used around the docks for transfer of goods.

Owing to the prevailing rates for ocean freight, it is unlikely that American car makers could find a profitable market there, for it now costs for freight charges an amount almost equal to the initial price of a good but low priced automobile.

THOMAS TO BE AT INDIANAPOLIS.

The Indianapolis speedway managers announce that Rene Thomas, who won the 1914 race, has cabled that he will be able to secure a furlough from the French army which will permit him to participate in the contest on Memorial Day. He expects to sail about March 25, arriv-



Transmission Assembly with Disc Drum Removed.

- | | |
|------------------------|-----------------------------------|
| 1—Disc Drum. | 4—Brake Drum Bronze Bushing. |
| 2—Disc Drum Set Screw. | 5—Channel Worn by Distance Plate. |
| 3—Disc Drum Key. | |

ing in this country April 1.

He will drive one of the Peugeot cars owned by the Indianapolis speedway corporation and one of his teammates will be Johnny Aitken. He will thus be pitted against Ralph De Palma, who won the race last year, in which it was impossible for Thomas to take part.

Thomas won his 1914 race in what, at that time, was very remarkable speed. He drove a Delage. His record, however, was very badly shattered last year by De Palma. Thomas made his first appearance as a motorcycle rider and from this he took up automobile racing. He has also had experience as an aviator.

This is his second trip to America. He will be met in New York City by representatives of the speedway and will be brought at once to Indianapolis, where he will immediately go to work on his car.

MOTOR CARS REGISTERED IN THE UNITED STATES.

THE following table of cars in the United States at the beginning of 1916 is lower than the registrations actually on file in the various states, for the reason that many cars and trucks are registered in more than one state and as far as possible these duplications have been eliminated.

The figures are eloquent of the large purchases of automobiles in all parts of the country. They show in general the enormous numbers of motor cars owned in the West and Middle West, and indicate that the South and Southwest are the most backward of all sections in the use of the automobile, a fact that is due largely to the large proportion of negro population in those sections:

State	Cars and Trucks	Pop.	Pop. Per Car
Iowa	139,808	2,220,681	16
California	163,801	2,893,465	18
Nebraska	59,140	1,264,999	21
South Dakota	29,336	689,277	23
Kansas	74,956	1,818,383	24
Minnesota	91,829	2,263,182	25
Michigan	114,845	3,035,148	26
Ohio	179,767	5,119,491	28
Indiana	96,915	2,807,480	29
North Dakota	24,678	726,142	29
Montana	14,520	452,774	31
Wisconsin	81,371	2,486,941	31
Connecticut	38,950	1,234,031	32
Vermont	11,499	363,075	32
Illinois	182,290	6,110,888	33
Arizona	7,320	251,422	34
District of Columbia	10,200	361,330	35
Oregon	23,758	822,615	35
Colorado	26,611	948,930	36
Rhode Island	16,362	608,540	37
Maine	18,600	770,064	41
Massachusetts	89,133	3,690,748	41
New Hampshire	10,819	441,545	41
Washington	36,905	1,502,632	41
Delaware	4,924	212,489	43
New Jersey	67,556	2,914,928	43
Missouri	76,462	3,401,241	44
Wyoming	3,976	176,853	45
Nevada	2,177	104,732	48
New York	212,844	10,179,971	48
Maryland	27,638	1,357,374	49
Texas	90,000	4,386,638	49
Utah	7,994	429,191	54
Pennsylvania	150,729	8,543,004	56
Idaho	7,093	420,291	59
Florida	13,123	882,148	67
New Mexico	4,947	403,600	82
Oklahoma	25,615	2,158,194	84
Tennessee	27,266	2,279,691	84
Virginia	21,357	2,181,516	102
West Virginia	13,256	1,372,756	103
South Carolina	14,500	1,616,610	111
North Carolina	21,160	2,386,916	113
Georgia	24,059	2,836,177	117
Kentucky	19,500	2,372,412	121
Louisiana	10,880	1,815,218	167
Alabama	13,798	2,316,943	168
Mississippi	11,500	1,939,226	168
Arkansas	8,021	1,726,413	215
Total	2,423,788	101,208,315	...
Average for United States			42

In the rank of the states according to the number

of cars owned there have been some changes in the last year. New York is still first and Illinois second, but Ohio is third, while California, which formerly held that position, is fourth.

State	Cars and Trucks	State	Cars and Trucks
New York	212,844	Virginia	21,357
Illinois	182,290	North Carolina	21,160
Ohio	179,767	Kentucky	19,500
California	163,801	Maine	18,600
Pennsylvania	150,729	Rhode Island	16,362
Iowa	139,808	Montana	14,520
Michigan	114,845	South Carolina	14,500
Indiana	96,915	Alabama	13,798
Minnesota	91,829	West Virginia	13,256
Texas	90,000	Florida	13,123
Massachusetts	89,133	Mississippi	11,500
Wisconsin	81,371	Vermont	11,499
Missouri	76,462	Louisiana	10,880
Kansas	74,956	New Hampshire	10,819
New Jersey	67,556	District of Columbia	10,200
Nebraska	59,140	Arkansas	8,021
Connecticut	38,950	Utah	7,994
Washington	36,950	Arizona	7,320
South Dakota	29,336	Idaho	7,093
Maryland	27,638	New Mexico	4,947
Tennessee	27,266	Delaware	4,924
Colorado	26,611	Wyoming	3,976
Oklahoma	25,615	Nevada	2,177
North Dakota	24,678		
Georgia	24,059	Total	2,423,788
Oregon	23,758		

SCRIPPS-BOOTH TAXES LOWEST.

Under the new Michigan automobile law cars are taxed on a basis of both horsepower and weight, and the blue book just issued shows the rates at which various cars are taxed. The American Mercedes, weighing 7498, was the heaviest car. The tax on a well known eastern car is \$27.25. From that point it ranges down to \$8 for the Scripps-Booth. The tax rate for Fords is \$9.25.

This is largely due to the light weight and small horsepower of the Scripps-Booth which, notwithstanding that fact, will make 53 miles per hour and because of its good balance will stick to the road and handle easily at high speeds.

BOSCH RACING FOLDER.

The races on the speedways and roads during 1915 are summarized in a neat publication by the Bosch Magneto Company. It is entitled "Conclusively Convincing." The company believes that every motorist should be interested in race results, because the race track is the great engineering laboratory of the business and stock cars from year to year are designed to keep in line with the principles developed in these tests.

It is pointed out that not only every car that won in these races, but every one that entered, was equipped with a magneto, a fact that is considered interesting in view of the controversy over the comparative value of magneto and battery generator ignition.

MOTOR STARTING AND CAR LIGHTING.

The Dyneto Single and Two-Unit Systems, the Designs of the Machines and the Means of Control, with the General Details of Construction.

BOTH single and the two-unit system for engine starting and car lighting are built by the Dyneto Electric Company, Syracuse, N. Y., a concern that has been active in the industry for

its voltage pressure, the generator will take current from the battery and become a motor, preventing the engine stopping and driving it at what may be termed "cranking speed" until it again takes up the load.

The differential compound winding of the machine, the reversed series winding, maintains the voltage supplied to the battery within a safe value, but no reverse current cut-out is used, opening the switch preventing the battery discharging through the motor.

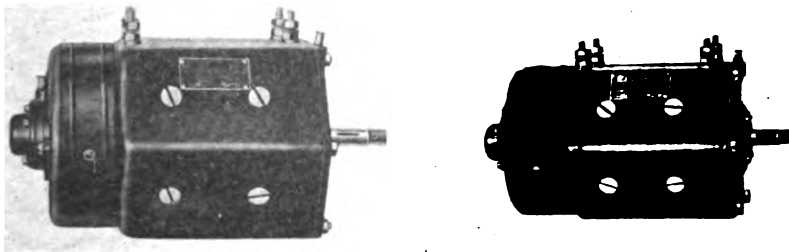
The Two-Unit System.

The two-unit system, however, differs with the single-unit in that it is designed to be oper-

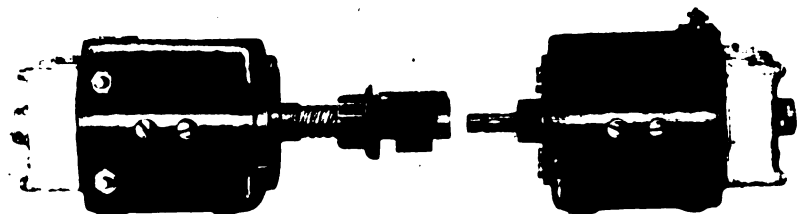
ated at six volts, which requires a three-cell battery, and the generator is driven usually by an outside shaft from the timing gears, while the motor is coupled to the flywheel by a pinion that meshes with an external gear either cut into or shrunk on to the periphery of the flywheel. Usually the coupling is either an inboard or outboard application of the so-called Bendix drive.

The generator is a plain shunt wound machine that is controlled by a combination vibrating regulator and automatic switch. The generator is designed to be driven at one and a half times the engine speed, and one of the qualities is that when the engine has reached a speed that corresponds to car speed of eight miles an hour current will be produced. This will have an amperage value of approximately six at 10 miles an hour and will increase to about 12 amperes at 12 miles an hour. There will be a slight rise to about 12½ amperes at 15 miles an hour, from which point the amperage will diminish very gradually,

four years, and which is well known to a considerable number of automobilists. The first production was a single-unit system in which the motor-generator was installed at the forward end of the engine and coupled to the crankshaft by a silent chain. Generally, this form of coupling was made without any form of over-running clutch, though this device was sometimes used. The motor-generator of this system is a conventional design, with the fields of the machine carrying two windings, the one a shunt and the other a reversed series winding, which serves as a bucking coil to regulate it as a generator, and which compounds with the shunt winding when it is a starting motor. The connection to the battery is made through the starting switch, which when closed starts the machine as a compound wound motor. The switch remains closed and when the engine starts it will drive the motor at a speed corresponding to that of the engine under all conditions. The ratio depends upon the size of the sprockets. When the engine attains a speed equivalent to what would drive the car from six to eight miles an hour, the voltage from the machine is sufficient to counteract the voltage of the battery, and current will flow from the machine to the battery so long as the engine speed is not diminished. In the event that the engine speed falls below that which will supply a current that will charge the battery against



The Dyneto Motor-Generators: At Left, Type B, Which Has Three Terminals; at Right, Type A, Which Has Four Terminals.



The Components of the Two-Unit System: At Left, the Starting Motor with Application of the Bendix Drive; at Right, the Generator.

approximating 10 amperes at 40 miles. In excess of that speed there is a slight additional reduction. One will note that there is a characteristic of quick maximum rise and a continued drooping as the speed of the machine is increased, which obviates overcharging, and yet insures charging when the car is driven slowly.

This construction is intended to provide adequate charging, and to maintain the battery charge at what is regarded as standard efficiency so far as this can be done. Obviously, the generator will afford abundant current for the lamps when the car is being driven at comparatively slow speed, and the greater part of the time the car is moving, this being particularly desirable when the machine is used but little during the day and much during the evening, so there will not be a heavy drain upon the battery, and yet long day driving will not result in overcharging.

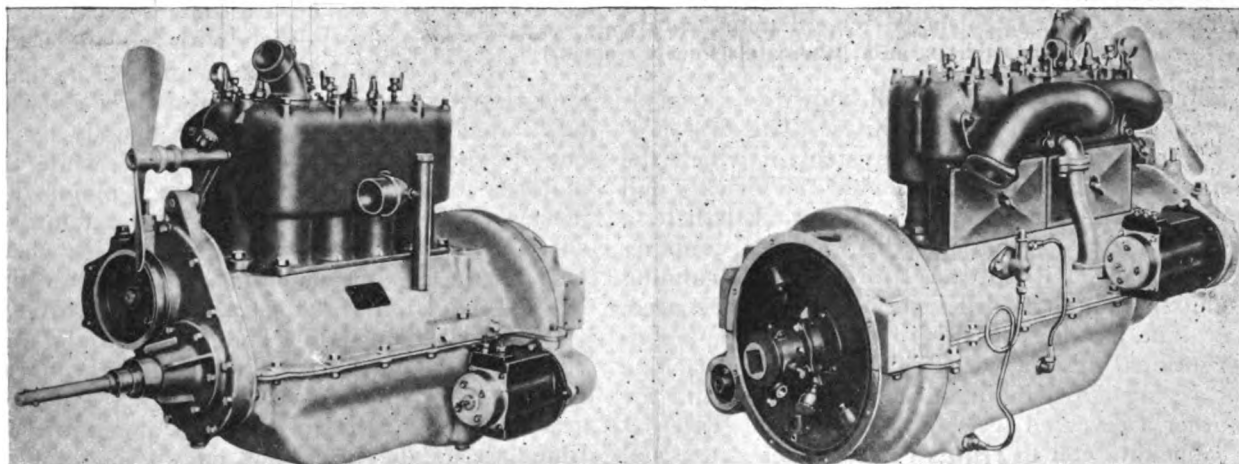
Frames Practically the Same.

The generator is housed in a rectangular frame that is practically the same as that de-

there is a uniform air gap between the poles and the armature. The commutator end housing is of aluminum and it is carefully machined, being faced for the rocker arm, bored for the bearing bushing and shouldered to fit the bore of one end of the magnet frame. The casting is then drilled for the screws. The drive end housings are designed to meet special requirements and one side is faced, shouldered and drilled to fit the magnet frame.

The armature shaft is made of nickel steel and is heat treated. It is specially ground on an automatic shaft turning and grinding machine to secure accuracy. The armature laminae are made of the best grade of electrical sheet steel and are individually keyed to the shaft and positively secured by special end collars. The commutator is made of drop forged copper segments that are insulated with mica and carefully assembled to insure solid connections, and there is sufficient metal to have sufficient conductivity.

The armature winding is carefully installed.



The Dyneto Two-Unit Lighting and Starting System Applied to a Lycoming Engine; at Left, the Motor Coupled to the Flywheels; at Right, the Generator Driven from the Timing Gearset.

signed for the motor, but the end housings and the shaft extensions differ to meet the requirements for the different engines on which they are to be installed, there being, of course, variance in the manner of mounting.

The generator magnet frames are made from steel castings with elliptical magnet cores cast integral, the frame castings partly enclosing the ends. Much care is taken in the preparation of the castings, the bases being milled on special machines to insure accuracy. The ends and the magnet cores are then bored at a single setting to a diameter somewhat larger than the polar bore. Both ends are next faced at one operation, so that they are exactly parallel and square with the base. The frame is then drilled and counter-bored and after they are inspected and enamelled they are ready for assembling.

Fitted for Four-Pole Shoes.

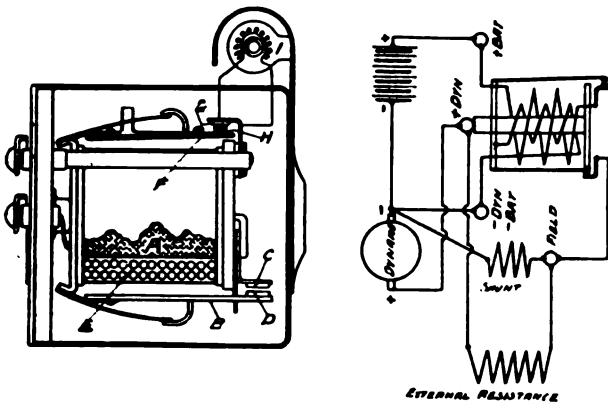
Four-pole shoes are used, these being of drawn steel that is accurately fitted, drilled and tapped, so that when assembled in the frame

The coils are formed of heavy copper wire, and after forming and insulating with cotton fabric, are laid in the longitudinal channels of the core. They are tested for imperfections before and after being connected with the commutator, and after examination are baked to dispel all moisture. The armatures are then impregnated with an insulating compound, and baked for the second time. They are reimpregnated with the insulation and baked for the third time and after inspection are ready for the assembler.

The field coils for the magnets are two in number for each machine. They are of heavy copper wire, covered with cotton fabric, that are wound on forms. After being tested they are taped, baked, impregnated with insulating compound and baked for the second time to insure endurance. Flexible leads are provided for all connections of the coils.

Bearings and Brushes.

The bearings of the generator are very large and are what is known as the "bronze-graphite



Sectional Sketch of Regulator and Diagram of the Wiring Connections.

oilless" type. While the statement is made that these bearings may be used without lubrication, recommendation is made that slight lubricating will probably insure the best service, so that the commutator end bearings are fitted with dust caps in which are inserted thick discs of felt that are saturated with oil, which will afford lubrication for a considerable period. The dust caps keep the bearings absolutely free of foreign matter. The drive end housings are fitted with oil holes in which are inserted felt oil plugs, which contact with the shafts and lubricate them by capillary action.

Two brushes are used, which are clamped in holders formed from heavy brass strips. Each holder is mounted on a brass stud, and the tension is insured by coiled springs that form part of the brush holder assemblies. No pig tails are used, the flexible leads from the windings being directly connected to the brush holders. The brush holder studs are mounted directly on the insulating ring or rocker arm, which ring is secured to the commutator end housing by four screws. An opening in the upper end of the housing, covered by a name plate, allows inspection of the brushes. The entire brush unit may be easily accessible for brush renewals by removing the housing, leaving the brush unit fully connected and in its position. No adjustment of the brushes is necessary.

The Regulator Cut-Out.

The current production of the generator is

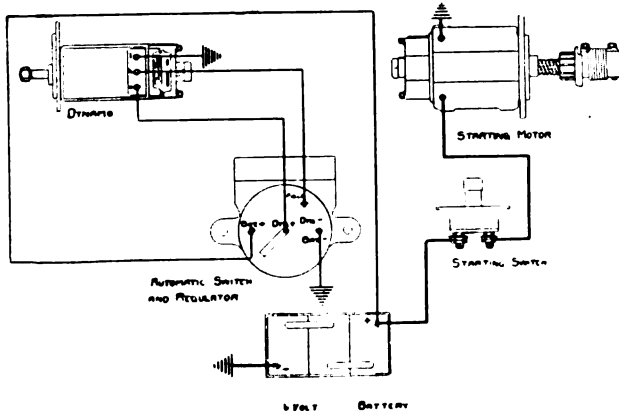


Diagram of the Single Wire or Grounded System of Connections.

controlled by the regulator cut-out, which is independent of the machine. The regulator is automatic in its functions and is a vibrator type. In connection with the description two sketches are shown, which should be referred to. When the generator is driven fast enough to generate current a portion of this current passes through the coil A of the regulator, magnetizing its core and attracting the armature B so as to bring the contact points C and D together. The closing of these points completes a circuit from the generator to the battery through the coil E, which consists of a few convolutions of heavy wire.

This is the charging circuit and the current in it varies with the speed at which the generator is driven until a maximum of from 10 to 12 amperes is obtained. The magnetic effect of the charging current in coil E is in harmony with that of the current in coil A, and as the charging current is increased the points C and D are pressed more firmly together because the core en-

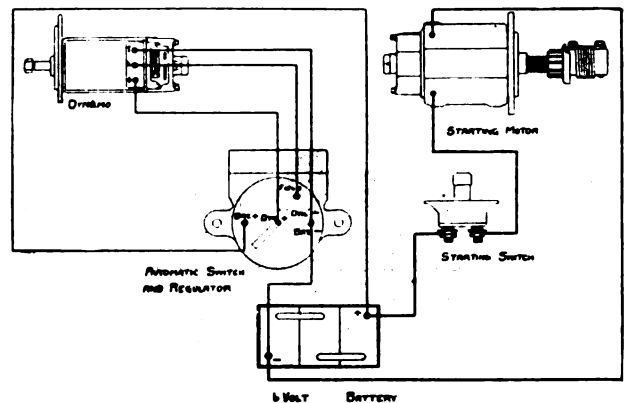


Diagram of the Two-Wire System of Wiring.

closed by the two coils is more strongly magnetized and the armature B is more strongly attracted.

The Armature Adjustment.

The armature F is adjusted so that with any increase of the current the contact points G and H are slightly separated. These points are directly in the shunt field circuit and a resistance coil I is connected across them so that when the contact points are together the coil is cut out of the shunt field circuit, and when they are separated the resistance is cut into the circuit. When the charging current has reached an amperage of 10 to 12 the increase of the current is resisted by the very rapid vibration of the armature F, which cuts the resistance coil F into and out of the shunt field circuit, thus weakening the field of the generator and keeping the amperage within the required limitation. When the generator speed is too slow to charge the battery against the voltage pressure, the armature B is released and the points C and D are separated, thus cutting off or disconnecting the battery and preventing its discharge.

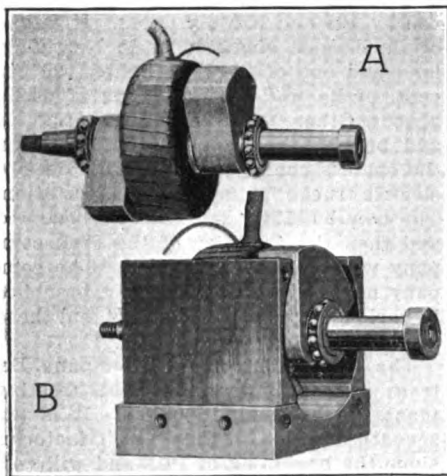
The Starting Motors.

The starting motors for the two-unit system do not differ in general appearance from the gen-

PRACTICAL FACTS FOR NEW CAR OWNERS.

Elementary Instructions in the Economical Operation, Maintenance and Repair of the Ignition System--The Remy RD Magneto--Answers to Inquiries from Subscribers.

THE chief distinguishing features of low and high-tension magnetos were explained in the Jan. 25 issue of this magazine, but in order that the reader may more readily grasp the points brought out in the following descriptions of the different commercial types, it is well to give a brief summary at this time.



A, Inductors, Mounted on Steel Shaft, Revolve Around Stationary Winding; B, Inductor Shaft and Stationary Winding Assembled in Base and Pole Shoes.

In the low-tension type a current of low voltage is generated, and this must be converted into a current of higher voltage before it is practical for ignition purposes. This is done by passing a current through a separate external coil, the transformer coil, which was described in the issue mentioned above. A distinctive feature of

the low-tension magneto is that its armature has only a primary winding. The transformer coil, however, has both primary and secondary windings.

A magneto in which is generated a current of high potential that can be used for ignition without passing through a separate transformer coil is said to be of the true high-tension type. High-tension current is generated by having two windings on the armature, one primary and the other secondary. It is generated wholly within the instrument, which should not be confused with the low-tension type that has a transformer coil attached to the top.

Armature and Inductor Types.

Commercial magneto ignition devices may be classified into two groups, according to the basic principles adopted to generate the initial electrical impulses in the magnetic field. These are termed armature and inductor types.

When the lines of force are cut by an armature with several thousand feet of fine copper wire, which revolves between the pole pieces of the magnets, the instrument is of the armature type. As the armature turns, electrical impulses are induced within the winding.

There are two classes of armature type magnetos, primary and compound. The first mentioned has but a single winding on the armature and generates a current of low voltage. It requires a separate transformer coil to step-up the current to a higher potential before it can be used for ignition purposes.

The compound armature type, as the name would indicate, has two windings on the armature shaft. There is also a condenser located in the armature. Because of the revolving windings employed in this type it is necessary to use brushes, collector rings or other kinds of sliding contacts to collect the current from the windings.

Inductor Type.

The inductor type consists of a revolving solid steel shaft upon which are mounted two steel, fan shaped inductor wings, within a stationary winding in the magnetic field. This design eliminates the use of brushes or other types of sliding and wiping contacts as the current is generated in the stationary coil.

The Remy model RD magneto is a two-magnet, low-tension, inductor type.

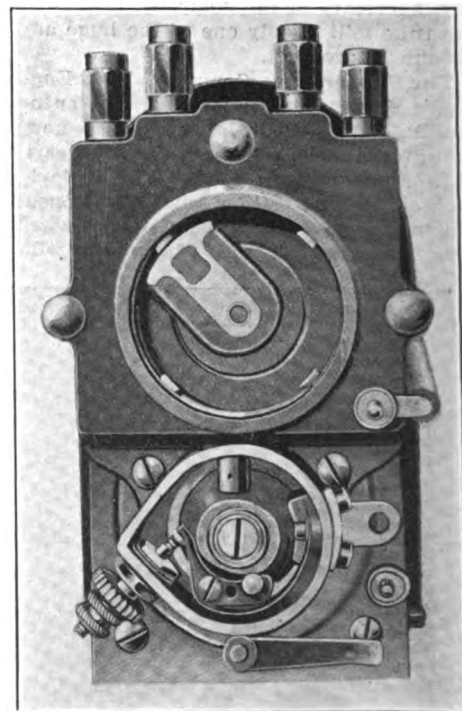
It has a stationary single winding of coarse magnet wire embodied in the pole pieces. The rotative part is a solid ground steel shaft upon which are mounted two simple inductor wings of laminated steel, one on either side of the winding. At each half turn of the inductor shaft the direction of the flow of the lines of magnetic force through the winding is alternately reversed, which induces two electrical impulses for each complete revolution.

The stationary winding is directly connected through the magneto circuit breaker with the primary of the separate non-vibrating transformer coil used in conjunction with this instrument. The circuit is mechanically broken during the current wave. The timing of the spark is accomplished by shifting the circuit breaker around the inductor shaft, to which is attached the circuit breaker cam.

For a four-cylinder motor the distributor has a two-to-one driving gear, so that the current may be properly distributed among the spark plugs after it has been sent to the transformer coil and stepped up to a higher voltage. It will be noted that in the wiring diagram shown, there is a high-tension cable leading directly from the transformer coil to the distributor. During each complete revolution of the inductor this cable carries two high voltage current impulses to the distributor. Because of the gear reduction the fan shaped distributor segment makes but one revolution to two of the magneto inductor. This arrangement permits the delivering of a spark to each of the four cables leading from the distributor to the spark plugs in the cylinders each time the magneto inductor makes two complete revolutions.

It is obvious then that when the instrument is used to supply current for a four-cylinder, four-cycle motor, the magneto inductor must be driven at crankshaft speed. When used with a six-cylinder, four-cycle engine, it is necessary to back gear the distributor with a ratio of one to three. This requires that the magneto be driven at $1\frac{1}{2}$ times the speed of the crankshaft.

The special step-up transformer coil supplied with this Remy type is fitted with a two-point kick switch from battery to magneto or vice versa, which disconnects either to stop the motor. The switch is also provided with a push button for starting the four or six-cylinder motor from the spark. This is accomplished by pushing the button when the switch lever is turned to the battery side, which directs the battery current through the coil and distributor. When the motor stops the distributor is in a position to fire the next cylinder in order. By turning the switch to



Type RD Remy Magneto with Distributor and Cam House Lids Removed.

HAPPENINGS AND COMMENT IN THE INDUSTRY.

The Chalmers Motor Company, Detroit, Mich., has installed four completely sound proof rooms, wherein is done the final testing of the motors that enter into the construction of Chalmers cars. These rooms have solid brick walls that are 24 inches thick. After the motors have passed through the usual rigid examination during the running in processes, when compression, tappet, valve, gear and other noises are sought for and eliminated, they are sent into the silence rooms, where experts give the final noise test with dynamometers. Each motor requires 15 minutes of searching examination before it is passed out of these rooms.

The Puritan Machine Company, Detroit, announces that its plant No. 2, which was started about six weeks ago to accommodate the rapid growth of the business, is now nearing completion and will be occupied not later than March 15. This addition was made necessary by the recent acquisition of the Cartecar and other companies by the Puritan company.

The Timken Roller Bearing Company, Canton, O., recently put in operation a new seamless tube plant which cost approximately \$500,000, and is said by men in the steel business to be the most modern mill in the country. The buildings are entirely of steel and are provided with the maximum of daylight and ventilation. The piercing and rolling mills, with their accessories, are of the latest design, and embody a number of patented features. The cold working department includes a pickle house, annealing furnaces, pointers, draw benches, straighteners, cutting off machines, etc., all being of heavy construction and the latest in design and practise. Heman Ely, secretary of the company, said that the tube mill is only one of the huge additions in prospect.

The Eisner-Lenk Company, New England's largest exclusive electrical automobile supply house, has built a new four-story modern building in the heart of Boston's motor district, at 1096 Boylston street, and will on April 1 hold open house for its friends. The sales room, general offices and testing laboratory will

occupy the first floor, while the others will be utilized as stock rooms. The battery testing room will be in the basement, where room for working on cars has been reserved. Eight machines can be taken care of at the same time. In speaking of the move, Mr. Lenk said: "The name of our house has been associated with the automobile industry almost from its inception, and in that time we have been forced to rent a suitable place, so we were forced this time to build. We are the only house of our kind in New England and are carrying the largest stocks of electrical automobile parts."

Alfred O. Dunk, president of the Detroit Motor Car Company, Detroit, recently discovered 300 car bodies that had been left over from the old company, and disposed of them by giving them to whoever would take them away. The majority of comers were school children, who took the bodies to their back yards to play with. Mr. Dunk was much gratified in this because he, as a member of the Detroit commission of public safety, saw that these bodies would help to keep the children out of the streets and out of the way of traffic, where so many have been injured.

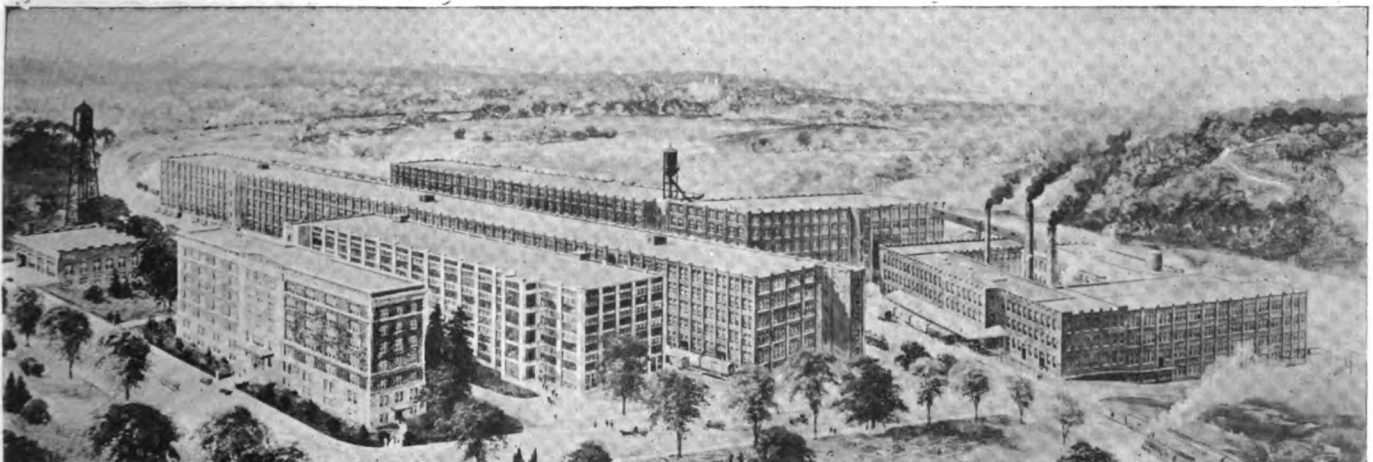
The Dort Motor Car Company, Flint, Mich., recently shipped a trainload of Dort touring cars, numbering over 200 machines, to a Minneapolis dealer. The freight charges were \$4000 and the dealer had put up in cash about \$135,000 for the shipment. This shipment is remarkable in view of the fact that the Dort company has been making automobiles only since nine months ago—before that time, for 30 years, it had been producing a high-grade line of buggies and farm vehicles. The credit for this showing is generally attributed to J. D. Dort, president; John D. Mansfield, sales manager; D. M. Averill, general manager.

The Fisk Rubber Company, Chicopee Falls, Mass., is one of the show places of New England, especially since the recent new additions have been constructed. The plant now consists of 20 buildings and has 29 acres of floor space. One of the buildings is 600 by 100 feet and has

about 360,000 square feet of space. The new administration building has been designed for beauty as well as utility and is of stone and tapestry brick and seven stories high. Directly back of this is the new warehouse, six stories high, and measuring 300 by 105 feet. It has about five acres of space. At each end are fire towers, while the windows are of prism glass to afford the maximum of light. The mill building, another new unit, is 600 by 105 and has six floors. It is one of the largest single mills in New England and one of the best lighted, 90 per cent, of its wall surface being of prism glass. Other features are the tunnels and bridges that connect the buildings, the endless conveyor and a large fleet of electric trucks for factory transportation. The new buildings will soon be occupied and then the facilities of the Fisk company will have been doubled. The company now has about 100 direct branches in various parts of the country and these are being added to constantly.

The Timken-Detroit Axle Company, Detroit, is erecting a new heat treating plant for handling its axles. It is the seventh addition to the Detroit factories since the beginning of 1916 and will cost about \$300,000 when completed. It will have two special rotary furnaces that embody all the successful improvements. Two large electric travelling cranes will handle the stock between the furnaces and cooling vats. The building will be 330 by 40 feet and three stories high. The first floor will be used for the heat treating department, while the other two will be devoted to other manufacturing operations. A tunnel connects the newly erected forge and the heat treating building, it running directly under the main Detroit plant.

The Willys-Overland Company, Toledo, O., on March 6 passed the 100,000 mark in its production of 1916 models, according to a telegram dispatched to President Willys, who then was en route to California. The 200,000 Overlands and Willys-Knight cars which are expected to be produced this year are sold and under contract. Overland now has 5000 dealers in this country and Canada.



Plant of the Fisk Rubber Company, at Chicopee Falls, Mass., Which Now Embraces 20 Buildings and Covers 29 Acres of Ground.

Cars That Never Grow Old

What do a few changes in body design matter, if your car is sound in its working parts?

Keep your car young by fighting friction in bearings and gears with



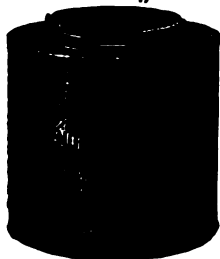
Wherever metal-to-metal contact sets up friction, NON-FLUID OIL inserts a lubricant film that prevents the parts from wearing, and makes motor cars run *smoothly, silently, swiftly.*

K-No. 00 Special Grade is for gears;

K-No. 000 for bearings. Get a supply from your dealer, or write for free samples.

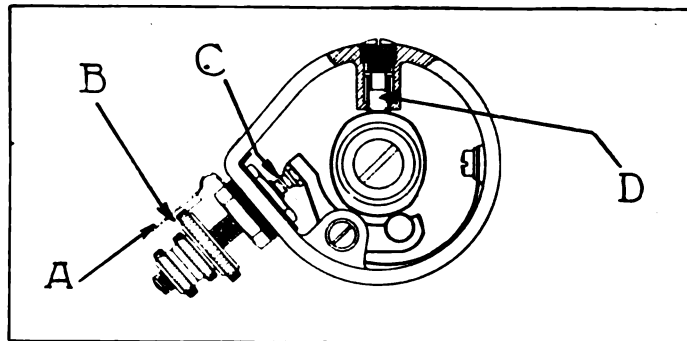
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**THE MAGAZINE
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ACCESSORY & GARAGE JOURNAL**

(When Writing to Advertisers, Please Mention The Automobile Journal.)



Showing Only Adjustment of Instrument—A, Spring for Securing Thumb Screw; B, Thumb Screw for Adjusting Contact Points; C, Platinum Points; D, Oiler Wick.

the battery side and pressing the button, a spark is created in this cylinder.

When conditions are such that the cylinder will not retain the compression, it will be necessary to crank the motor to draw in a fresh charge by some other means. The manufacturer states, however, that when the fuel charge is guaranteed the Remy RD guarantees the ignition spark.

Lubricating.

The instrument requires but little lubrication. About every thousand miles a few drops of oil should be applied to the three oilers. The breaker cam is lubricated by a felt wick, which should be inspected periodically to determine that it is well saturated. Should it appear dry, saturate with oil from a squirt can. Ordinarily a few drops will suffice for a year.

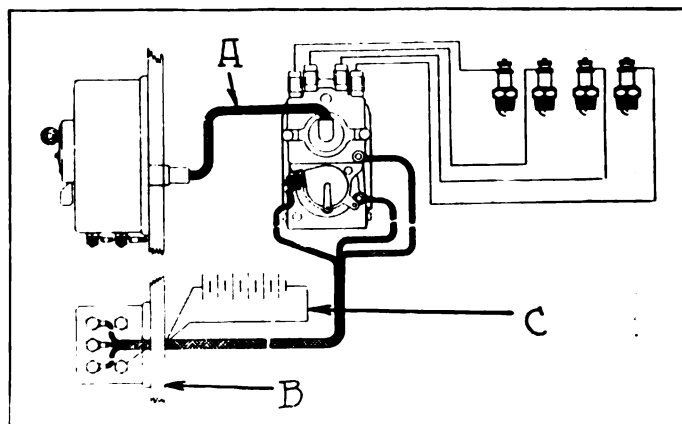
Timing.

The Remy RD magneto is timed to the engine by the break of the contact points. When the piston is at the exact dead firing point the cam house must be in the full retard position, and the platinum points should be just separating. The high-tension, or secondary, cable from the cylinder, which is on the exact dead firing centre, should be connected to the distributor terminal, corresponding to which the distributor segment is opposite. The remaining distributor terminals should then be connected up in the proper firing order of the motor.

Adjustment.

The only adjustment necessary on this type of magneto is made by the contact screw in the breaker. The adjustment should be such that the maximum break of the platinum points is between .025 and .03 inch.

If the motor shows a tendency to miss when the spark is retarded and misses more at low speeds than at high, the contact screw should be screwed out a notch at a time until the trouble is overcome. Should the condition be the reverse, that is, missing occurs when the spark is advanced and it increases at high speeds, the contact screw should be screwed in a notch at a time until the trouble is remedied.



Four-Cylinder Wiring Diagram —A, Wire from Transformer Coil to Distributor; B, Arrangement of Wires Under Coil; C, Battery.

CORRESPONDENCE WITH READERS.

Motor Overheats—G. M. B., Fairfield, Conn.

What do you suppose is the cause for the overheating of my engine? On a mild day the radiator will become so hot that the hand cannot be placed on it. I am using a large percentage of denatured alcohol to prevent the freezing of the cooling system. Do you think that alcohol will cause rapid heating?

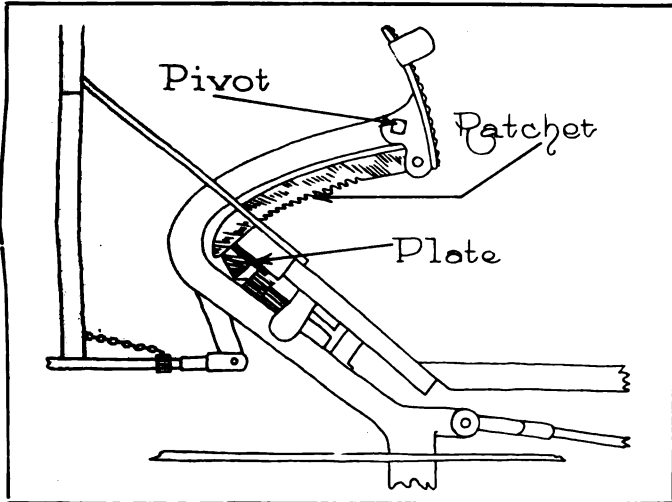
You have not submitted sufficient details to enable one to arrive at a definite answer. Of course you no doubt know that there are several reasons which may be suggested as the cause of rapid heating. If your trouble only occurs on mild days there is little reason for doubting that the presence of alcohol in the system is the cause. The reason for this is that the boiling point of alcohol is considerably lower than that of water.

Reo Clutch Pedal—T. G. F., Binghamton, N. Y.

Can you tell me what is the matter with the clutch pedal on my Reo car? It is supposed to lock down, but does not. The brake pedal cannot be relied upon to hold down.

With proper usage there is no reason why the pedals should not lock out. The locking is accomplished by a ratchet fitting a small plate under the floor board. The pedal is pivoted at the centre so as to allow it to rock and the ratchet is firmly attached to its lower part. With proper use the ratchet will grip when engaged with the plate.

When depressing the pedal the pressure should be applied to the lower part. This will throw the ratchet away



Showing Working Principle of Foot Pedals Used on Reo Car.

from the plate. To lock down, apply slight pressure to the upper part. This will cause a tooth of the ratchet to engage the plate. Never depress by applying the pressure to the upper part because the ratchet would be forced against the plate and a groove would be cut in the latter.

Would advise that you remove the small plate from the car. If grooves have been cut in it by the saw like action of the ratchet, it will be necessary to replace it with a new one. It may also be necessary to file the teeth of the ratchet.

Use of Oversize Tires—T. J. L., Bismarck, N. D.

Will the use of oversize tires on the front wheels of a car affect the recording of the speedometer and to what extent?

An oversize tire is usually a half inch greater in diameter and a trifle over three inches greater in circumference than the standard tire. If a speedometer is geared to register accurately when the wheel is fitted with the standard size tire, it is only natural to suppose that the instrument will register less speed and less mileage when the wheel is equipped with the oversize tire. The operation of the instrument does not rely on the actual distance travelled by the car, but on the number of complete revolutions of the front wheel. If the wheel is fitted with oversize tires, it will turn a less number of revolutions for a given distance than will a wheel that is fitted with the standard size tire. As an example, suppose a speedometer is geared to be operated from a wheel 30 inches

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in diameter and a 31-inch tire was fitted to the wheel. When the car has actually travelled 30 miles the speedometer will have recorded but 29 miles.

Equalizing Brake Action—Des Moines, Ia.

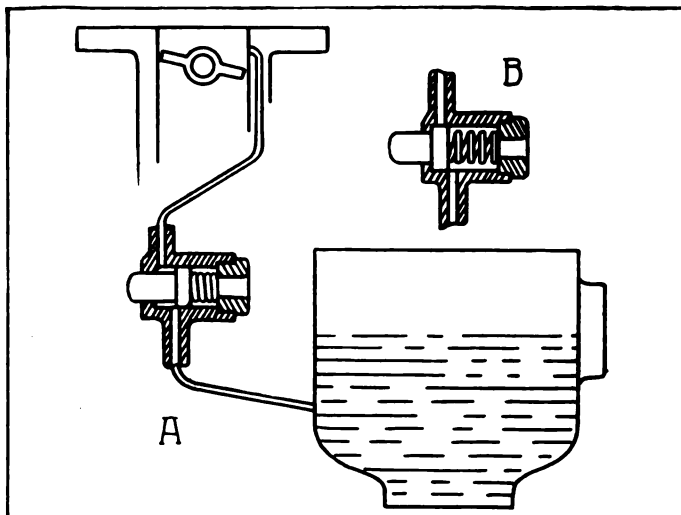
Will you inform me of the method used to determine which of the brakes grip first? In emergencies, the brakes do not respond promptly, although they seem all right most times.

It is imperative that the adjustment of both the brakes be equal if prompt response is to be expected. Jack up the rear of the car so that both rear wheels are clear of the ground. Have a friend apply the brake while you try to turn the rear wheels by hand. Should you be able to turn one of the wheels more easily than the other, adjust the brake on that side until an equal amount of strength is required to turn both. Unequal brake action will cause skidding on slippery surfaces and also will result in excessive tire wear.

New Priming Device—G. C. M., Lake Pleasant, Mass.

I would like you to publish in an early issue the working principle of the priming device which is incorporated in the model M Rayfield carburetor.

The model M Rayfield carburetor as equipped with the priming device shown in the accompanying illustration, is said to greatly assist starting in cold weather. It consists of a priming plunger that connects with the dash adjustment button. When the button is raised to its full height, a cam pushes in the priming plunger, as shown at A. When the



New Priming Principle of Model M Rayfield Carburetor—A, Plunger Open; B, Plunger Closed.

valve is in this position the suction created by the pistons draws raw gasoline from the fuel reservoir and carries it through a narrow channel, past the butterfly valve and into the cylinders. With this device it is not necessary to prime the motor through the relief cocks on the cylinder heads.

The position of the priming plunger under ordinary operating conditions is shown at B. When in this position, it is impossible for raw gasoline to be suctioned into the cylinders.

High-Test Gasoline—F. C., Fairhaven, Conn.

How does that gasoline advertised as "high-test" differ from the fuel offered for sale at filling stations?

High-test gasoline is a particular grade of gasoline that possesses certain advantages in industrial processes. It is always sold at an advance in price over the kind which is supplied at automobile filling stations. For ordinary pleasure car use, this advance in price, considering the benefit derived, would not warrant its use. There is not the same amount of heat or the mileage to be obtained from it that will be given by ordinary gasoline. The advantage claimed for high-test gasoline is that the explosions in the combustion chamber occur more nearly instantaneously and, therefore, produce the power quicker.

Gasoline is graded according to its specific gravity, which is determined by the use of a hydrometer. If a fuel is listed at 65 degrees, the hydrometer when placed in the fluid will

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sink the point where these figures are shown. Baume's hydrometer is much used for testing the specific gravity. With this instrument the following rule is used to determine the specific gravity of a fluid:

$$\text{Specific gravity} = \frac{140}{130 + \text{hydrometer reading}}$$

It will be readily seen that the higher the reading on the hydrometer, the lighter is the fuel.

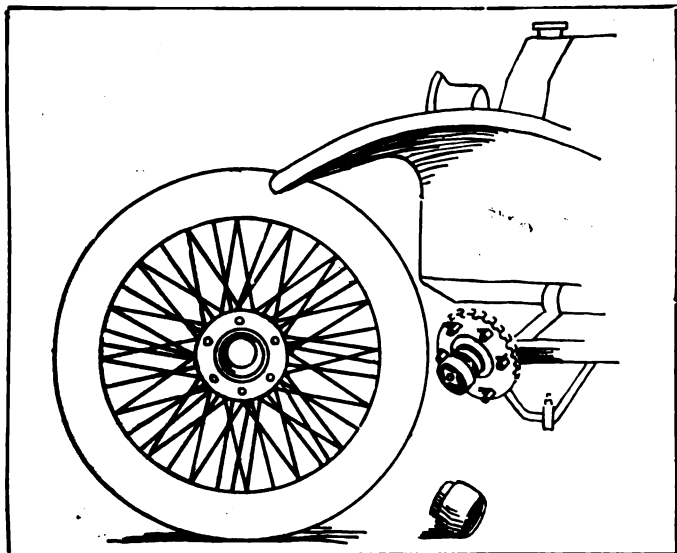
Wire Wheels—B. M., Long Island City, N. Y.

Kindly publish in the next issue of The Automobile Journal if wire wheels are as strong as the ones which use wooden spokes.

When replacing a front wire wheel, is it necessary to remove the bearing?

There can be no doubt as to the strength of the wire wheel in view of the severe tests to which it is subjected on racing machines. Although given terrific strains on such cars, the writer can recall no instance in which a wire wheel has collapsed. The same cannot be said of the wheels which have wooden spokes.

It is not necessary to remove the bearing when it is desired to take off the front wheel. The accompanying illustration shows the manner in which the wheel is mounted. An inner hub is mounted on the axle spindle and the wheel is then placed on this hub. The removal of a single lock nut will allow the wheel to be slipped off. When the car is in motion the clamp nut is self-tightening and cannot work off under any condition.



Removal of Single Lock Nut Allows Wire Wheel to Be Taken Off Axle.

This design affords the utmost simplicity of operation and a consequent minimum of physical labor. In several races, tires and wheels have been changed in a very few seconds when wire wheels were used.

Determining Horsepower—F. H. H., Boston, Mass.

Why is it that manufacturers have different horsepower ratings for motors? I notice that two concerns which manufacture motors having the same bores rate them at different horsepowers.

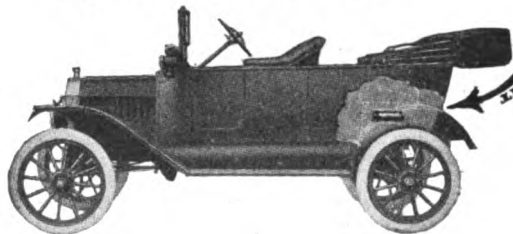
It is generally understood that the manufacturer's horsepower rating is based on actual tests. Computing the horsepower of a motor by considering the bore only is not a fair estimate. You do not state whether the stroke was the same in both motors. A shorter stroke will cause the engine to develop less power. Design is another factor in obtaining the actual rating. All manufacturers do not rate the motors at the same speed. For this reason two motors which develop approximately the same power at equal speeds may be given a different rating. The S. A. E. formula, which is the one adopted in this country, is based upon a piston speed of 1000 feet per minute. It is obvious that many motors are capable of a higher normal piston speed.

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Knocking—N. K. Y., Janesville, Wis.

I have often seen it stated that a large deposit of carbon in the cylinder will cause a pronounced motor knock. If there are no loose bearings, what part of the assembly does the knocking?

A large carbon deposit in the cylinder will quickly become incandescent and cause preignition. When this condition exists, complete combustion takes place before the piston has passed top centre. The knocking is caused by the piston hitting against the cylinder wall.

Bell Connections—G. LeM., Fall River, Mass.

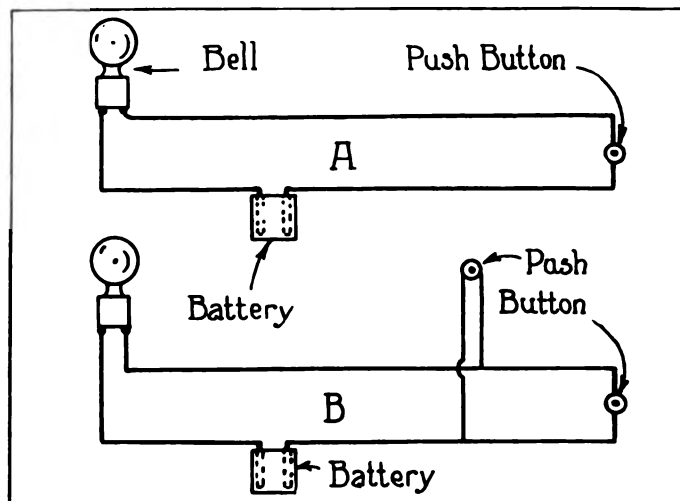
Will you please print the correct wiring diagram for a call bell, the connection to be made between the office and the shop? Will you also show how this bell can be wired so that it can be operated from two independent push buttons?

The simplest wiring system for a bell to be operated from a single push button is shown at A in the accompanying illustration. Either a dry cell or wet battery will give satisfactory service for this purpose. It will be seen that the only function of the push button is to complete the circuit. The wiring diagram of a bell to be operated from two independent switches is shown at B. It is practically the same as shown at A, except that there are two extra wires to connect the second switch into a circuit.

Reducing the Consumption of Fuel—R. H., Rock Hill, S. C.

What in your estimation is the best way to reduce the consumption of gasoline? Do you think the price will be reduced in the summer?

Your questions are difficult to answer. Not knowing the



A. Wiring Diagram for Operating Bell from One Push Button;
B. for Operating Bell from Two Push Buttons.

condition of your car, it is only possible to state the chief causes of gasoline waste. These may be divided into five classes; namely, design, mechanical imperfections, adjustments, lubrication and the judgment of the operator.

If the motor is wrongly designed there is no remedy. Many of the earlier models of engines are excessive gasoline consumers.

The second class, mechanical imperfections, comes under the control of the owner. Worn bearings, leaky valves, worn valve guides, scored cylinders, cracked manifolds, etc., may be classified under this heading. The remedies are obvious.

Under the caption of adjustments, the carburetor will no doubt require the most attention. One has but to breathe in a part of the exhaust gases emitted by the average car to ascertain that an excessive amount of gasoline is being used. The correct mixture is obtained only when satisfactory operation is produced by the use of the largest possible volume of air. The carburetor is often termed the heart of the motor and if the owner is not proficient in its adjustment he should consult an expert.

If the front wheels are out of alignment, a greater amount of fuel will be required to propel the vehicle. Dragging brakes is still another cause. A slipping clutch, poor ignition and improper timing are other common causes of excessive gasoline consumption.

If each working part of the car does not receive its full quota of lubricant, friction will be produced. It is obvious that it will require a greater amount of power, and consequently fuel, to overcome the friction.

Much of the economy of operation is dependent upon the judgment of the driver. The car should be fully throttled when coasting down grades, also when not in motion. When allowing the car to remain outside in the cold, place heavy wraps over the hood and radiator. This will preserve the heat and greatly facilitate starting and save gasoline. Carbon should be removed from the cylinders at regular intervals and at least once a year the muffler should be cleaned. A clogged muffler will produce back pressure.

According to present conditions there is no indication that the price of gasoline will be reduced materially.

Formulas—H. L., Lansing, Mich.

Being a subscriber to your publications I would like to take advantage of the Reader's Department.

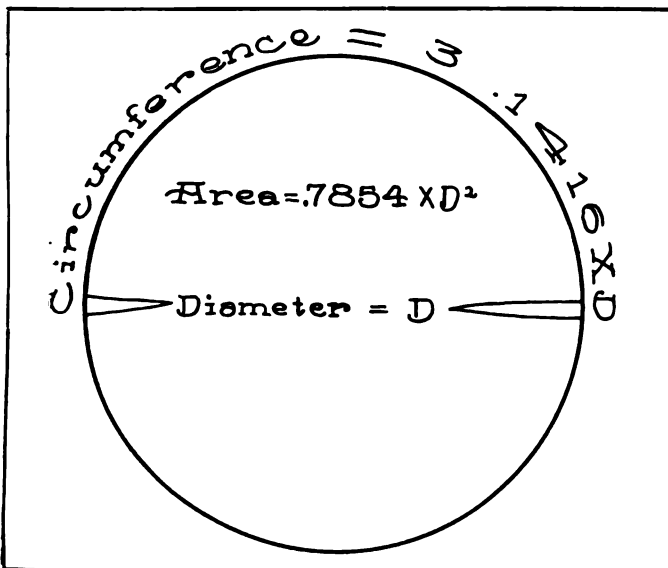
How is the area of a top of the piston found?

How is the circumference found?

How is piston displacement for one cylinder found?

To find the area of the top of a piston, it will first be necessary to find the diameter. The diameter of any circle is its greatest width, measured in a straight line. The formula for obtaining the area is to square the diameter and multiply the product by the constant .7854.

Circumference is the distance around a circle. It is obtained by multiplying the diameter by the constant 3.1416.



Formula for Finding Circumference and Area of Circle.

The piston displacement of any cylinder is found by finding the area of the piston and multiplying the product by the stroke. The result, of course, will be in cubic inches.

The circle shown in the accompanying illustration will serve as a key to the formulas.

Hill Climbing—F. O., Hinton, Ia.

Under which condition is the greater amount of gasoline consumed; if the car is driven up a steep grade with the intermediate gear meshed or when driven up the grade on direct? By direct I mean that the car was in high speed, but the motor was only just turning over when the top was reached.

This is a debatable point. Many experts have said that the greater fuel economy is obtained by climbing the grade with the intermediate gear engaged. The reason that some drivers do not change to a lower gear when the engine commences to labor is that there is clashing, which is due to lost momentum. Whenever this reason is advanced it is certain that the operator still has something to learn in the art of gear changing.

Others boast that they can climb any grade on high and consider it a lack of ability when it is necessary to shift to a lower gear. It is the good driver that will change to the intermediate, or even to the low gears rather than cause the engine to labor on high. To force the car to climb the grade

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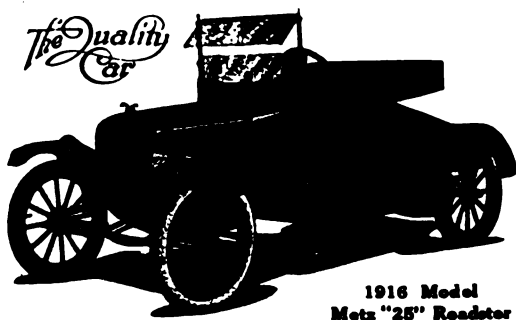
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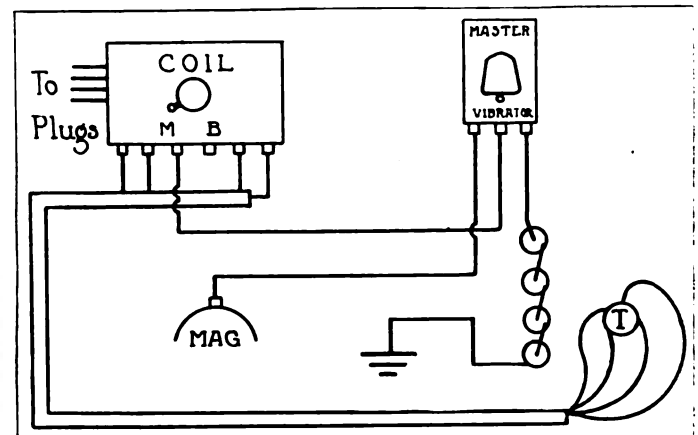
on direct with the motor laboring causes an excessive strain on the crankshaft, connecting rods and bearings. The shifting to a lower gear greatly reduces this strain.

Ignition Trouble—A. H. P., Fall River, Mass.

I have a Ford car which is equipped with a master vibrator. While using it I cannot get a spark at the plugs. The secondary wire when grounded on the motor will give a good spark, but when attached to the plug the vibrator will buzz, but there is no spark. Enclosed please find my wiring diagram. I have screwed down vibrators on the coil; have attached small wires between primary and secondary wires near vibrator, but the results are the same. At one time the car ran with the master vibrator and at present runs good on the coil, but would like to use master vibrator.

There appears to be nothing wrong with the wiring diagram submitted, from which accompanying illustration was made. The wires leading from the battery and the magneto have been removed from the original coil and connected to the terminals of the master vibrator. From the middle terminal you have run a wire to the magneto terminal of the coil. It is essential, therefore, that the coil switch should remain in the magneto position at all times. The battery terminal on the coil remains unused. Turn the adjusting screw on each of the vibrators until the platinum points are held tightly together. This will allow the current to pass through the coil without causing the vibrators to buzz. The master vibrator, however, is adjusted similarly to any vibrator on the original coil.

You do not state whether you are using the magneto to supply current for lighting purposes. If so, the wire leading



Wiring Diagram of Ignition System Used on Ford Car and Incorporating Master Vibrator.

to the lighting switch should be connected directly to the magneto terminal on the engine case and not to the terminal of the coil.

Would advise that you carefully inspect the wiring for worn insulation and also to determine that all connections are tight. If, after following these suggestions you are unable to locate the trouble it would be advisable to send the master vibrator to the maker for examination.

Suctioning Gasoline—R. J. L., Escoheag, R. I.

Will you please publish in an early issue of The Automobile Journal the method used for suctioning gasoline from the storage tank?

While there are several methods for suctioning gasoline from a storage tank, the principle is always the same. The air must be removed from the passage through which the fluid is to pass. Most motorists form the syphon by placing one end of a tube in the fluid and the other end in the mouth. By drawing on the end of the tube in the same manner as a man smokes a pipe, all air will be removed. The pressure will force the fluid to rise in the tube and be discharged. The disadvantage of this method is that the operator is apt to receive a quantity of the gasoline in his mouth.

Another method of creating a syphon is shown in the accompanying illustration. A bent tube with arms of unequal

length is used for the purpose. The long arm of the tube is filled with water and the end plugged so that it cannot run out. The short arm is placed in the gasoline. By removing the plug and releasing the water from the long arm, a syphon is created.

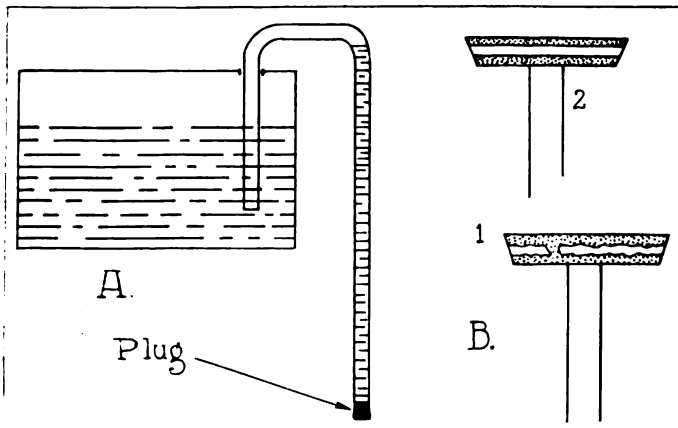
Seating of Valves—G. H., Utica, N. Y.

Will you publish in the Readers' Department of your magazine the method used to determine whether or not the valves of a motor require grinding? How is it done?

When there is lack of compression and power it is always advisable to examine the valves. If the exhaust valve does not seat properly there will be loss of compression and power and a weakening effect on the mixture. If it is the inlet valve which does not seat properly, there will also be lack of compression and frequent backfires through the carburetor.

This condition is not always proof that the valves require grinding, as weak springs will produce the same effects. It may also be that the valves do not seat properly because of the presence of soot and gummy oil around the valve stem. In that case grinding will not effect a remedy; they should be cleaned with kerosene. When there is a leaky valve, it can be detected by turning the motor over slowly by hand. The leak will be evidenced by a strong hissing sound.

If it is decided that the valves require grinding, they should first be ground with a mixture of oil and emery and then finished with a mixture of oil and ground glass. Before beginning the work place a piece of waste in the opening of



A. Method of Syphoning Liquid from Tank by Using Bent Tube and Water—B. 1. Valve Not Properly Ground; 2. Properly Ground Valve.

the combustion chamber so as to prevent any emery from reaching the cylinder. Only a small quantity of the abrasive paste should be applied to the valve at one time.

But slight pressure need be applied to the valve when grinding it and only half turns should be made, first in one direction and then in the other. Clean and wipe the valve and seat frequently and note the extent of the bright line which will appear. At first this line will appear to be irregular and broken, as shown at 1 in the accompanying illustration, but do not consider the operation completed until a continuous bright band like that shown at 2 is produced. If the surface of the valve is badly worn it may be necessary to file it before grinding. The grinding must be done with the valve held in a chuck and not in the hand.

In answer to a query which appeared in the Jan. 25 issue of The Automobile Journal relative to preventing lubricant leaking from rear axles, the Joseph Dixon Crucible Company, Jersey City, N. J., has very kindly submitted the following information:

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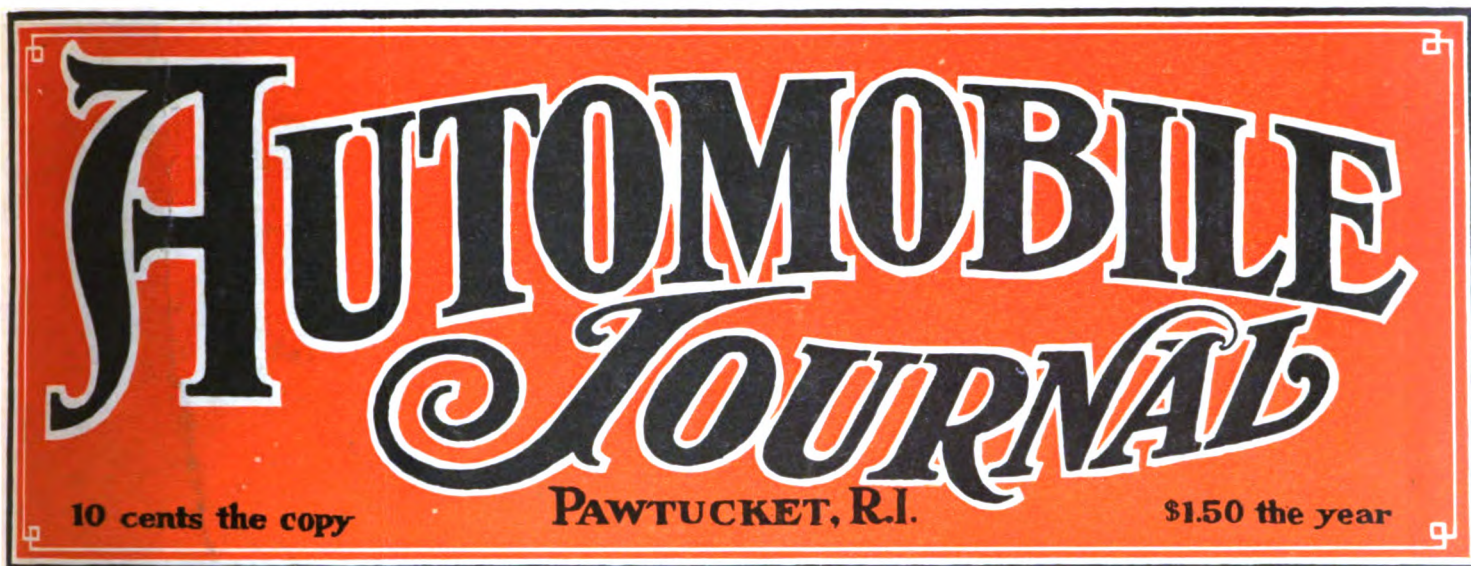
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VOL. XLI.

MARCH 25, 1916.

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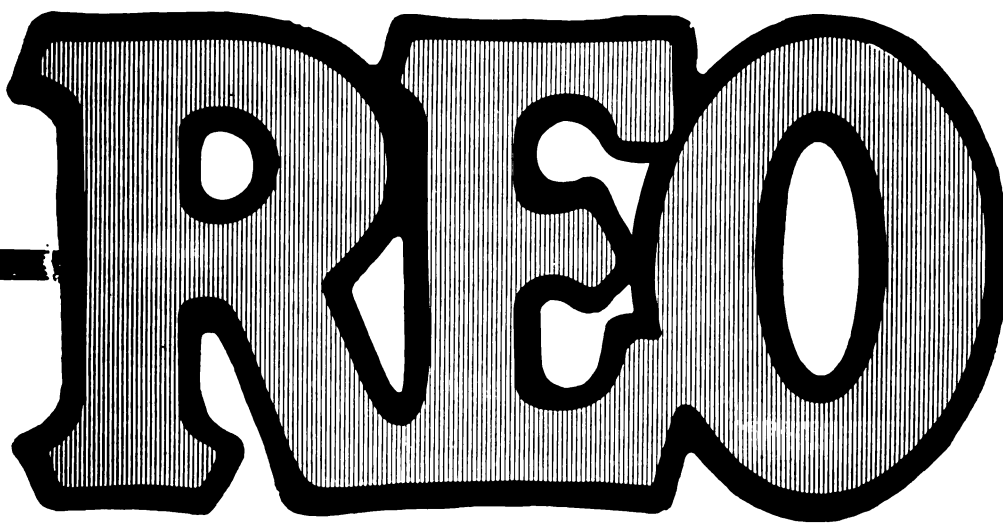
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VOL. XLI.

MARCH 25, 1916.

NO. 4.

The Publisher's Comments.

TOURING and Preparing the Car for service are matters now uppermost in the minds of thousands of motorists, especially in the Northern tier of states which have been covered with a heavy mantle of ice and snow. The spring sun is now unfettering this section and the roads will soon be in condition for long distance touring. But before the motorist goes out upon the road the car should be thoroughly overhauled and put in condition for service. Though few owners relish the idea, the work must be done. Those who have owned cars for more than a year know, to a certain extent, what is to be done and how to do it, but the "new owners" lack this experience and should seek advice. The May 10 issue of The Automobile Journal will contain a comprehensive and authoritative story on the subject and in addition the Publisher has a very valuable book entitled, "Overhauling," which will be sent to applicants upon receipt of 50 cents.

The Safety First Movement is receiving the unqualified support of car manufacturers and dealers throughout the nation, and should have the same from every person owning or operating a motor car. The educational campaign will soon be in full swing, which is well, because the highways of city and country are even now thronged with cars. This campaign is not confined wholly to motorists; it is also intended to convert pedestrians to the necessity of exerting more care in crossing thoroughfares, etc. Correcting the evils of vehicular and pedestrian traffic is not a matter for legislation solely; greater and more lasting results can be obtained through educating every person, driver or walker, in the inherent rights of each class.

Motor Truck Manufacturers and their employees, recently exhibited an admirable spirit in meeting the requirements of the government for motor vehicles to accompany the Mexican expedition, as is shown in the leading article of this issue, Motor Trucks in Warfare. This spirit is practically universal throughout the American industries, and, should the occasion demand, the government would receive all the support it could desire from both managers and workmen. The speed with which these motor trucks were assembled and sent to the border is another illustration of the excellent industrial system in vogue in the motor vehicle industry which makes it possible to produce such good cars in huge volumes and at low prices

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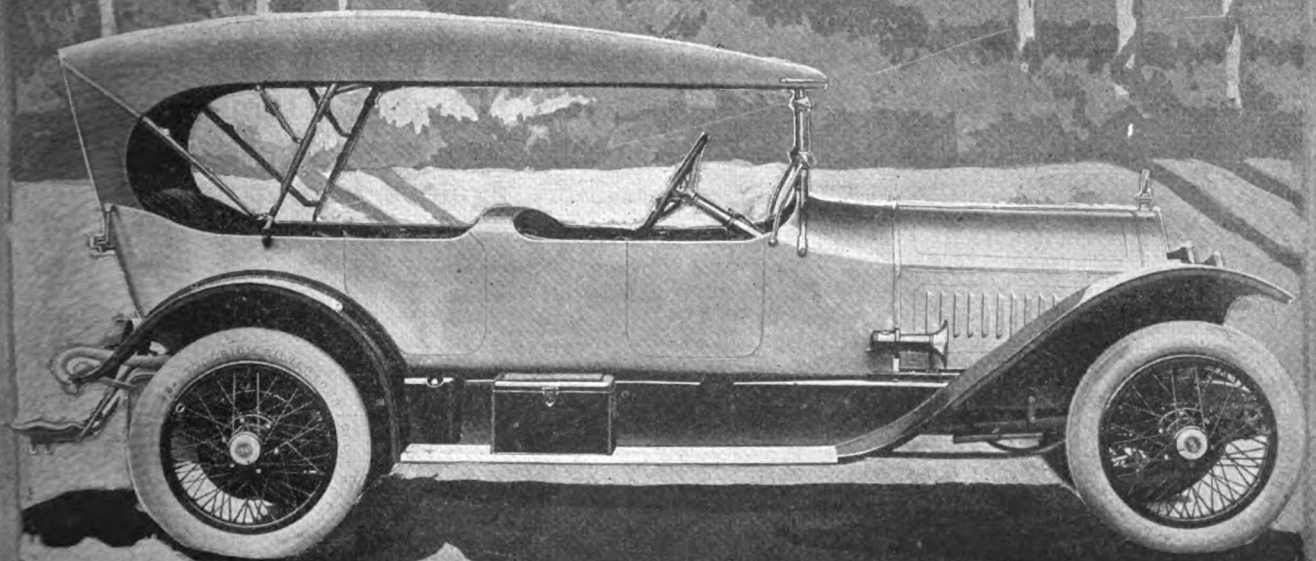
World's Champion

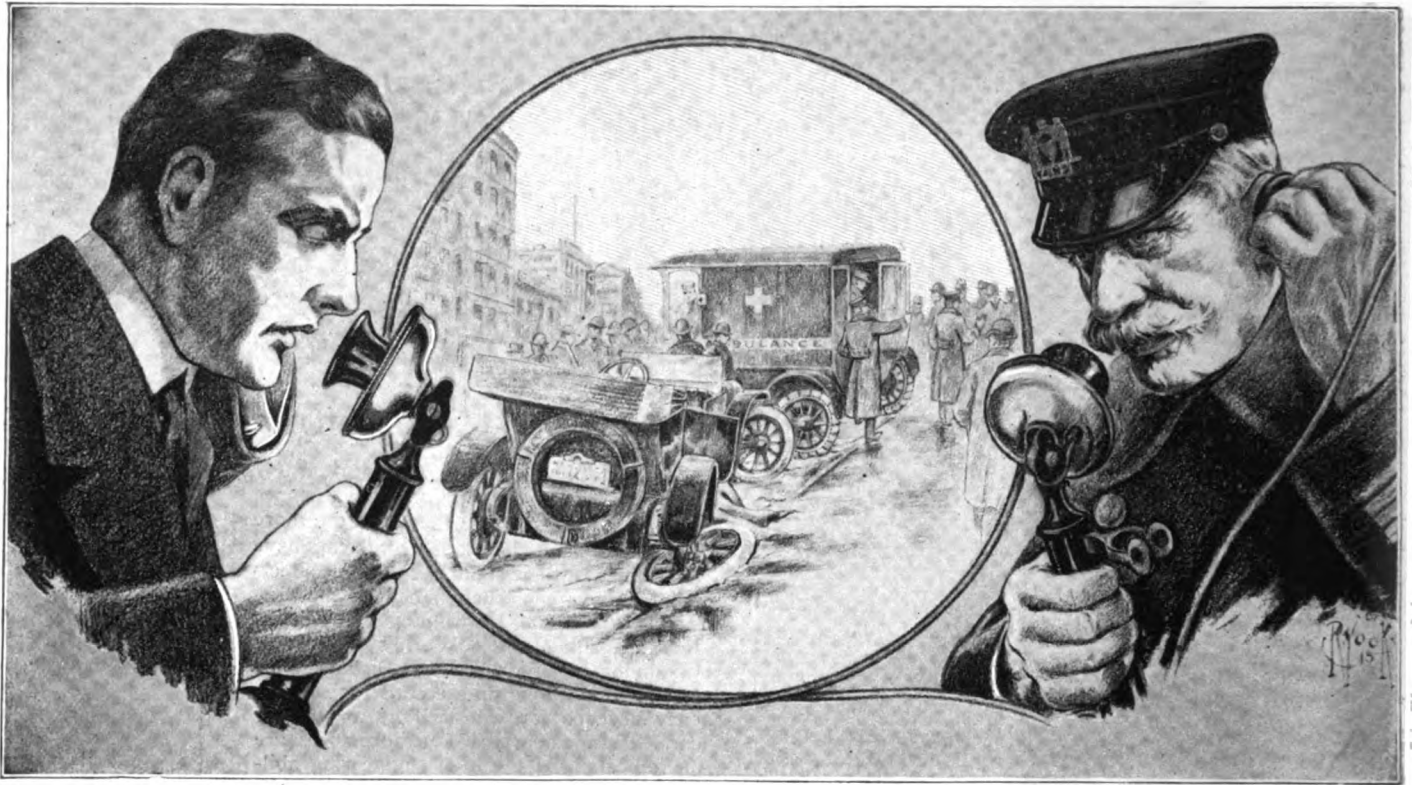
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Automobile Journal

MARCH 25, 1916

VOL. XLI

NO. 4.

Motor Trucks in Warfare

IN PREPARATION for the expedition into Mexico to capture Villa, one of the first actions of the army authorities was to buy motor trucks. Scarcely had orders been given to move the troops when the quartermaster's department asked various makers for bids on a large

number for immediate delivery.

The manufacturers showed the greatest willingness to cooperate by diverting trucks that had been intended for other purchasers and in 48 hours trainloads of various types were on the way to the border. They went from the White company's factory in Cleveland, which supplied a trainload of light vehicles; from the Jeffery factory at Kenosha, which sent a trainload of its famous four-wheel drive trucks, and from the Packard factory, from which 28 worm drive, 1½ units went forward.

In less than 22 hours after the government had placed its order with the Packard factory for 27 trucks a special train consisting of 14 steel freight cars and one Pullman car containing 33 Packard employees, who had been transferred to the government pay roll to operate the trucks, started for the Mexican front.

The train was scheduled to make the trip in 51 hours—the fastest time ever made from border to border. The government had all tracks cleared, but no information was given out as to the destination.

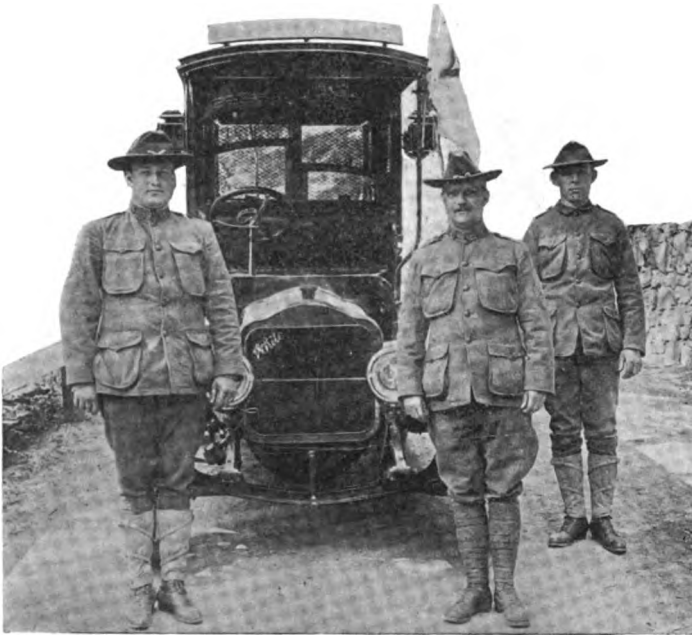
Tuesday morning an assembly of the

workmen was called and the officers of the company asked for volunteers to go with the trucks for immediate service in Mexico. Nearly a thousand men raised and waved their hands. The 33 men chosen were given six hours to gather their effects and settle their affairs. In less than two hours after order had been received a special night force of workmen was at work in the truck shops. Many of the foreign-born as well as American employees were among those who wished to volunteer.

The Standard Oil Company had at



Volunteers From the Packard Company Who Went to Operate the Trucks and Keep Them in Condition.



American Army Ambulance on White Chassis

Boston three tank wagons which were to have been used in oil distribution, and it consented to the sale of these to the government for use as water wagons to keep the expedition supplied.

For the chassis that were supplied direct from the factories bodies which had already been built were forwarded at once to the border by the Quartermaster's Depot at Jeffersonville, Ind.

During the week in which the trucks were being prepared for the expedition 100 New York chauffeurs applied for positions as drivers and no difficulty at all was experienced in obtaining the required number and kind of civilian drivers and mechanics.

Each truck company, made up of vehicles of one make, consists of 27 working trucks and a repair car. The men in charge are one truck master, three assistant masters, 28 chauffeurs, one machinist and one helper.

The first truck owned by the United States army was of

five-ton capacity and was purchased in 1907. Before the present expedition started there were 103 trucks used by the quartermaster's department.

Roads Are Very Difficult.

The roads used by the troops are desert trails, unimproved and very difficult, and even with the best of truck equipment the army expected great difficulty in keeping its columns supplied. After the cavalry had penetrated 100 miles into Mexico General Funston asked for the use of one of the Mexican railroads for supply purposes.

From this it would appear that with the number of trucks available and the condition of the roads, so long a haul was found too difficult for the trucks to handle the full volume of transport. The general apparently had in mind a system in which the railroads would carry the material most of the distance to a base and from there the trucks would be used for shorter hauls, as they have been in the European war.

This call for trucks for the American army has again brought attention to their place in modern warfare. It emphasizes the lessons on truck use which the European armies have taught the world. The coincidence which brought on the war just as the motor vehicle and more especially the motor truck was perfected has had enormous consequences for everyone concerned.

For the truck industry and the truck maker the war has been the most gigantic and successful advertising campaign that can be conceived. It has convinced men everywhere that the truck is a thoroughly able and practical vehicle and has enormously aided its introduction into the work of the world when peace reigns.

For the business men of the world it has pointed the way to solve especially difficult transport problems, to attain speed in hauling and the ability to cover long distances, as well as to cut costs. It has given him a confidence in motor vehicles which in peaceful times would only have been created slowly through years of experience.

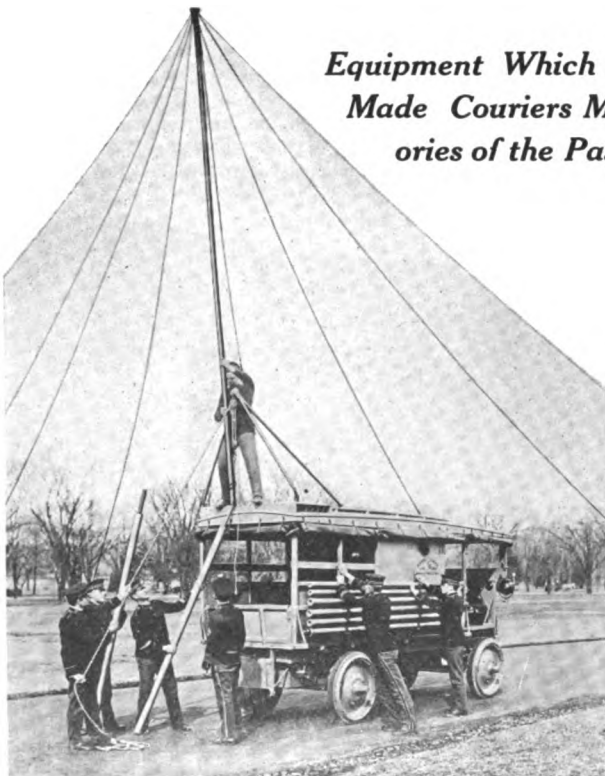
For the soldier the use of motors has largely rewritten the science of strategy. War will never again be what it was before the motor vehicle was available. It has greatly increased the importance of the infantry and artillery divisions of the army while, in country which is densely settled and the roads are good, the importance of the cavalry has been correspondingly diminished.

For the farmer it has proved all the points that have weight with other business men, and in addition it has given a new value to the development of good roads and greatly strengthened a movement for road improvement which seems destined to end only when the main roads of the world are hard surfaced.

Motors Supplant Railroads.

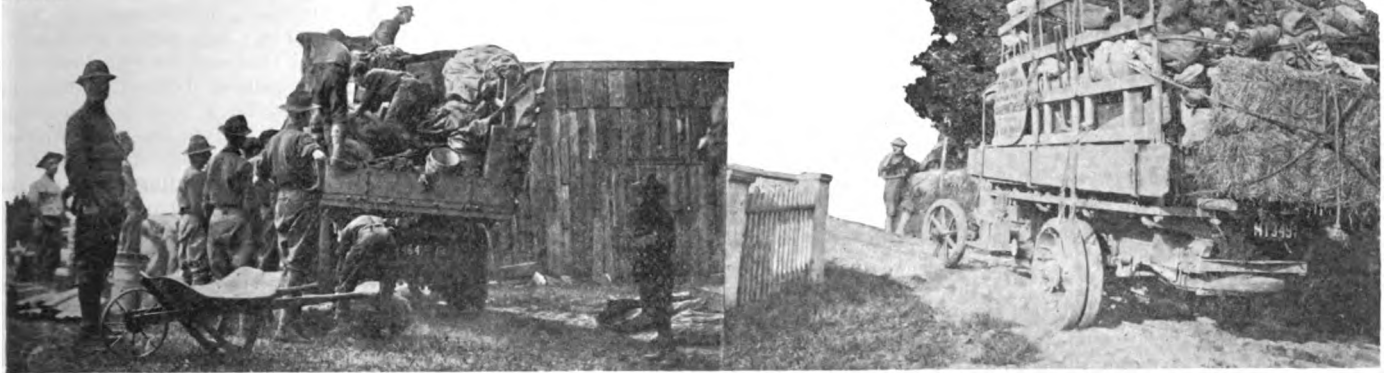
In backward and developing countries it has to a certain extent checked the building of railroads into thinly settled sections where for years they must be operated largely at a loss and has turned attention instead to the cheaper, and in the circumstances, more practical plan of building hard-surfaced highways over which trucks may carry passengers and freight.

Equipment Which Has Made Couriers Memories of the Past.



Two Views of a Portable American Army Wireless Plant on a Jeffery Four Wheel Drive Truck.

The great service of the motor vehicles in war has been the increased speed at which they have made it possible for large bodies of infantry to be rushed across the country, and the equally great speed at which supplies may be transported.



Trucking the Army's Baggage and Equipment Into Camp at the End of the March—The Era of "Horseless Warfare."

In the ambulance corps the motor—usually of the passenger car type—has similarly speeded up the treatment of the wounded and has been the means of saving a portion of the men who have been incapacitated because of the increased efficiency of armies due to the use of motor vehicles in other branches of the service.

Another of the motor's contributions to the art of war is its use as a fighting machine. In Europe hundreds of cars were equipped with armor to cover their vital parts, manned by fighting men and with a light field gun or two or three machine guns were sent out on the road, constituting a more terrible form of cavalry than it was ever possible to create when animals were used.

Artillery has been mounted on motor chassis permanently so that it could be hurried from place to place along the battle lines. And heavy tractors of four-wheel drive or other types have been developed to haul the very heavy guns from place to place.

Anti-Zeppelin Guns Moved.

Anti-aircraft guns, which have been used for the first time in the European war, have especially depended on motor chassis for quick transportation. In England, where there have been frequent raids by Zeppelins and where it has not been possible to build enough of these guns to defend all of the cities, they have been placed on motor vehicles for quick movement to any threatened point.

In the early days of the war, before entrenchments were perfected with barriers and mines, motor cars were fitted with long knives which curved from the ground clear over the body of the car. These could be driven at high speed straight into a barbed wire entanglement and could cut a way through it at one sweep. Through this opening infantry and other branches of the service could follow more or less unimpeded.

Before the war on the western front settled down to a siege between two perfected lines of trenches and there was much quick advancing and retreating, many of the trucks used for the transport wing of the armies were lost through artillery fire or through being wrecked or lost and gathered in by the enemy.

But in the later stages of the war the wastage of trucks has been very much reduced. It has grown to be the custom not to allow them to approach nearer than within a mile or two of the battle front, and the result is that many which went into service at the beginning of the war are still working, and because they receive excellent mechanical attention are still in good condition.

One of the spectacular motor features of the early part of

the war was the stopping of the German drive on Paris by thousands of soldiers of the city's garrison who were rushed to the front in the omnibuses and in taxi-cabs.

Trucks Last Well.

Many of these cars are still giving the best of service. Of course the high speed at which the vehicles are almost invariably driven over bad roads has put many of them out of operation. But it will probably be found at the end of the war that a surprisingly large number will survive.

The railhead in the communications column is usually 20 or more miles back from the front. Here are great depots containing ammunition and supplies which are not required immediately at the front. At these depots the motor transport is loaded and sent on its trip to within a mile or two of the front. There the material is unloaded and placed in animal-drawn vehicles to be taken up to the battle line.

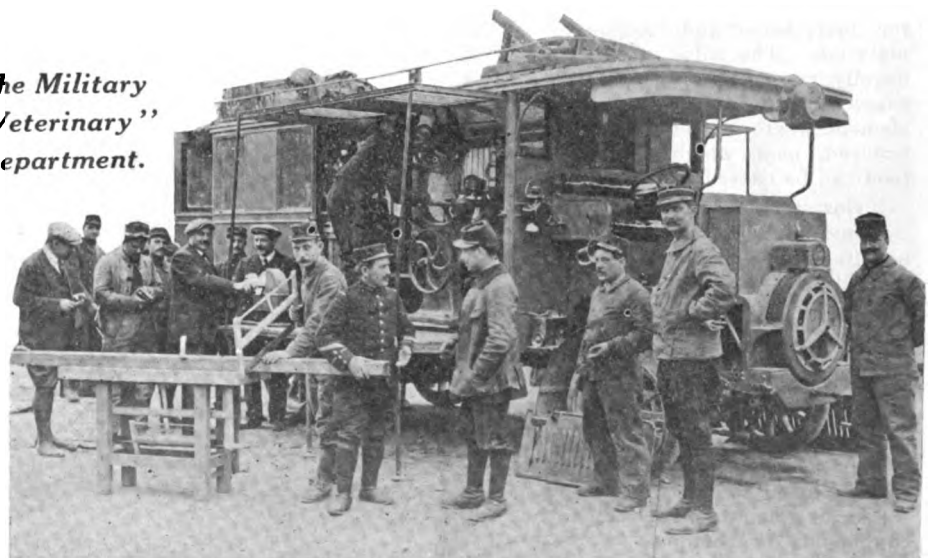
Thus, it is only on rare occasions that the trucks come within sight of the enemy. Those which are used to transport supplies other than ammunition work on a fairly regular schedule in a fashion not greatly different from trucks in use in civilian pursuits. The ammunition trucks lead a more irregular existence.

They may be idle for 10 days and then be worked for 48 hours without a stop. They are kept at the depots back from the line and are constantly loaded with ammunition so that when the call comes it can be rushed to the front with the smallest possible delay. A driver is always on duty beside them and the instant a telephone call comes, the whole convoy is off on its trip.

Trucks Kept in Hiding.

Of course much of the heavy artillery will fire a shell many miles, and so there is always danger that a convoy

The Military "Veterinary" Department.



A Motor Repair Shop In A Truck As Used by the French Army.

Fortresses Now Travel On Wheels.



A French Armored Car Carrying a Machine Gun.

will be bombarded after it gets within five or six miles of the front. For this reason the trucks are often painted in such a way as to make them indistinguishable at long distances. Sometimes the sides are painted to resemble a brick wall or some other landmark; sometimes the color is merely such as to afford the smallest possible contrast with the dominant color of the country.

If it is possible to avoid it, trucks are never stopped on an open road, but come to rest under trees so as to be invisible to any passing aviator who might direct his artillery to bombard them. For this reason also when they are parked in the open squares of the towns along the route they are always placed under the trees.

An ordinary heavy duty truck of the type that has been purchased by the Allies in great numbers from America will accommodate 30 men when it is used to carry soldiers from one point to another in the line. More can be hauled if the men hang on to the rear step or the side boards. Some of these trucks make about 20 miles an hour and provide fully as rapid transportation as that given by the ordinary military train. Only the officers' cars, dispatch cars and ambulances are faster.

To the engineer and the military man one of the most interesting things developed by the war are the many applications of the motor vehicle to the special military needs. Varied were the types designed and built in great profusion during the first few months of the struggle when nearly every mail from Europe brought news of some new use for motor cars.

Thousands of motor kitchens were built for the purpose of preparing food for the troops either on the march or in camp. It is probable that the settling down of the armies, especially on the west front, to comparatively permanent quarters has made these less useful than they would have been to armies constantly on the move.

They are equipped with cooking ranges of the gasoline or kerosene type, have built in water tanks, great coffee urns and bins for flour, sugar and various food materials. The sides of the body usually can be raised to form a canopy to afford protection in inclement weather, and a counter is exposed, over which the cooked food can be passed to the men.

Hospitals of Many Kinds.

Many varieties of motor field hospitals also were supplied. These carried tents in which the wounded could be treated. They were equipped with water tanks and heating apparatus to prepare hot water for the physicians. Many of them had small dynamos driven by the vehicle's motor to supply electric light for the operating table and the hospital.

Special apparatus, such as X-ray equipment, is common in these installations. In the French medical service a powerful

magnet has been developed, it drawing its power from the car motor and being used to draw steel bullets and steel fragments of shells from the wounds of the men, and in many cases this preventing blood poison and the various ills that result from a bullet wound.

For night fighting in the trenches motor vehicles were developed to carry great searchlights. The lights are usually mounted on a light, rolling chassis that can be removed from the truck and wheeled into any position desired within the length of the electric cable carried on a reel in the truck. The motor of the vehicle operates a dynamo of sufficient size to supply the necessary current.

In all advanced military practise, including that of the United States army, the motor vehicle has also been adapted to the uses of field wireless telegraphy. The wireless instruments are carried in the truck and a long pole, which is in sections, is equipped for use as an aerial. In many cases the vehicle motor operates a dynamo which supplies the current by which messages are sent.

Motor cars with especially designed trailers to take their aeroplanes from place to place are used extensively by the aviation services of all the armies.

For both the aviation and the motor corps there are motor repair shops in the field. These consist of trucks with enclosed bodies which contain work benches and a full complement of hand tools, and some small machine tools which are operated by the motor of the truck. Other trucks accompanying the repair shops carry a great variety of repair parts.

Small Moving Machine Shops.

These repair shops are capable of being moved quickly from one point to another and are supplementary to the great permanent repair shops often located in a factory in the base town. They have added greatly to the efficiency of the motor wing of the armies.

In addition to using motors to transport guns and ammunition, the artillery branch of the service finds them very useful for transporting various types of observation outfits. These may consist of balloons which are sent up with an artillery officer to watch the effect of the gun shots and to report over the telephone to the officers in charge of the guns the effect of the shots so they can correct their ranges. These balloons are of the captive type and are anchored to the trucks on which they are transported. A very similar equipment is that which relies on a series of very large box kites to lift and hold the officer aloft. Both types have to be fitted with power winches operated by the truck motors so that if they come under the fire of the enemy the observer can be rapidly brought to earth.

For the heavy haulage over very rough ground it has been found advisable to supplant the ordinary truck or tractor with a larger and heavier type of machine, which is usually equipped with steel tires and sprags, or with a caterpillar wheel.

Motor trench diggers, usually driven by steam, have come into use and the steam tractor is used in hauling plows and

An Indispensable Part of a Modern Army.



A White Truck Used by the Massachusetts Arsenal.



The Dreaded "Motor Cavalry" On the Road in France.

other trench tools. The English use, back of their lines, a considerable number of steam trucks which are in common commercial use in England, but the French and other armies have not adopted them.

This great array of motor equipment in use in modern warfare contrasts sharply with the last campaigns fought over the same ground, in 1870. At that time the Prussians used two steam traction engines for hauling, but that was the extent of the employment of motors.

The use of motor vehicles in war have resulted in much increased speed in all departments. They have been proved economical, because motor supplies are cheaper than forage for animals. A single road can be used much more effectively than formerly, due to the greater speed and also to the fact that a truck takes far less room on a highway than the horse or mule wagons that would be used to haul an equal amount of material.

EMPIRE PRICE UNCHANGING.

Eight years ago the Empire Auto company, Indianapolis, produced a light two passenger roadster which was popular at \$950. During each succeeding year, as improved methods reduced the general level of automobile prices, the company was confronted with two possible policies; one was to reduce the price and the other to make the car larger and better at the old price. The latter course has been followed, and every year the Empire has been improved while the price has remained between \$900 and \$950.

This year a six-cylinder model of large size and imposing appearance was produced and this was priced at less than \$1100. The winter business for the Empire company has been greater than the busiest month of the spring selling season in other years.

HOW TO AVOID SKIDDING

What to do with a skidding automobile is told by F. W. Muller, a well known authority in motor vehicle practise. He urges that anti-skid chains be always used when there is danger of skidding and that they be carried in the car.

In case they should be forgotten, Mr. Muller warns drivers to leave the brakes alone, drive slowly over slippery places, and turn the front wheels in the direction in which the rear wheels start to slide. Skidding, he says, is due to the fact that the momentum of the car is a greater force than the friction of the tires against the ground.

Skidding almost always occurs when an attempt is made to change the direction in which the car is going. Then the inertia of the car leads it to keep on in the original direction of travel, overcoming the resistance of the rear tires. It is important to get the rear wheels rolling again, because if they do that they will follow the front ones.

He lays great emphasis on the utility of tire chains, which, he says, should be always a part of every car's equipment.

TAXI FIGHT IN BOSTON.

The police, the large cab companies, and hotel owners in Boston are opposing a regulation which would abolish the right of hotels to rent the taxicab stands on the public streets about their places of business and leave them open to any operator who has a license.

This bill is supported by the independent motor cab owners and by a portion of the public which believes that it would thereby secure better rates. The police declare it would disrupt traffic regulations, and the drivers' union opposes it because its members who are employed by the big companies might be thrown out of work.

As all stands would be open a great deal of "back mileage" would be avoided and that would tend to make a lower rate possible. The Taxi-Service company has 170 cabs; Rackett Taxicab company, 22 cars; Saunders & Butler, 25 cars; Armstrong Transfer Company, 30 cars. There are 140 independents.

BROOKLYN SHOW BIG SUCCESS.

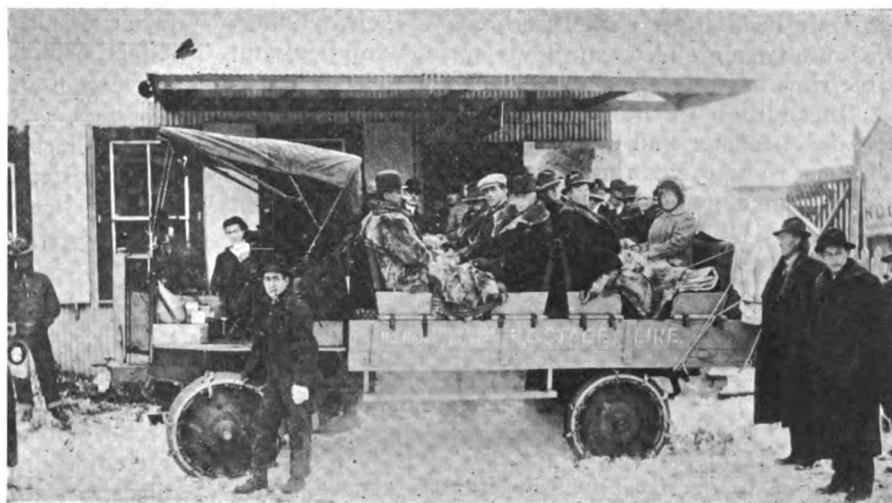
When the Brooklyn automobile show which was conducted by the Long Island dealers, came to an end March 15, 60,000 people had seen the exhibits. The number of orders taken was declared by the exhibitors to be greater than at any Brooklyn show that has ever been held. It is said that the orders actually taken at the show amounted to \$250,000 while the number of prospects located was much greater.

Most of the sales were of passenger cars although the truck end of the business was by no means inactive. After the show the dealers had a banquet at the Turtle club. The sales were very well distributed, practically all the dealers sharing in them.

BEGIN MAINE HIGHWAY WORK EARLY.

Bids have already been opened for highway work on some of the roads in Maine this year. Operations are to begin early in April on a four-mile stretch still remaining unimproved on the road from Portland to Portsmouth, N. H. It is hoped to have this finished by July 1 and so avoid the condition that resulted last year when the very heavy rains made the detour roads a sea of mud.

Work will begin early also on a road between Jackman and Rockwood to Moosehead Lake, which will go through a dense forest. Contracts have already been let for clearing the right of way and digging out the grubs. The road will not be completed this year. It will reach the lake opposite the Mt. Kineo house. At present the only route to the lake is by way of Greenville.



A Jeffery "Quad" at War with the Elements—This Motor Truck Is Used in Alaska to Transport Freight and Passengers and Must Break Its Own Trails Through the Snow During Many Months of the Year.

CAMPBELL IS HIGHLY HONORED.

French Government Appoints Him Manager of Paris Exposition.

Chester I. Campbell, who for several years has made the Boston automobile show one of the greatest successes in its field in this country, is recipient of signal honors from the French government. Mr. Campbell recently received a cable announcing that he had been appointed American manager for the Reconstruction Exposition to be held in Paris during May, June and July of this year. The Exposition is being sponsored by the government of France, and is in charge of the Administrator General, Edouard Tijou.

While Mr. Campbell fully appreciates the distinction accompanying the offer he also appreciates that it is a rather large task for a single man. His friends and associates in the management of the Boston show are certain that he is fully capable of rising to the expectations of the French authorities.

In the opinion of Mr. Campbell, who is closely in touch with every phase of the motor vehicle industry in the United States as well as in foreign countries, France is extremely in need of gasoline tractors, delivery wagons, automobile parts and accessories. He said: "They are particularly anxious to secure every sort of machines, hardware, fixtures, machine tools, farm implements and portable houses."

When last interviewed Mr. Campbell signified his intention to accept the offer, providing he can satisfactorily arrange his other business affairs, among which is the management of the fifth national textile exposition in Mechanics building in April.

NEW FOSTORIA LIGHT CAR.

The price of the New Fostoria Light car has been set at \$675. It is full sized and well powered, using a large number of well known parts, and is worked out to eliminate as much weight as possible. It has 108-inch wheelbase, has a 27-horsepower, four-cylinder motor and weighs 1910 pounds with electric lighting and starting and complete equipment. The motor is a valve-in-head type, with three by 4½-inch cylinders, vacuum gasoline feed, cantilever springs and demountable rims.

In addition to the touring car there is a roadster, coupe, speedster and delivery wagon, all on the same chassis. The prices range from \$495 to \$825.

The management of the company is in the hands of R. J. Ridgway. The factory manager is George Rosino, who is assisted by C. E. Cox. Some of Fostoria's wealthiest business men are interested in the enterprise, which has, therefore, substantial backing.

NEW EXPERIMENTS IN LIGHT WEIGHT.

For several years constant effort has been made by engineers to decrease weight, increase speed and to build a light, but substantial and durable motor car body, but as long as efforts were devoted to accomplishing it without change of material, lightness was

generally secured at the cost of weakness.

According to F. E. Moskovics, commercial manager of Nordyke & Marmon, that company as early as 1912 began experiments with aluminum alloys to cut down weight. After many months a metal lighter, but stronger than cast iron and many steels, was produced.

In the fall of 1913 the car was put together for the first time and motor tests on a block were begun. It was tested thoroughly on the Indianapolis speedway and was tried out through the mountains and over the deserts of Arizona. This proved that the car had the qualities which had been sought.

The seven-passenger car which resulted, the Marmon 34, weighs 3540 pounds fully equipped and with tanks full for the road. The shipping weight is considerably lower. This is practically 25 per cent. less weight than is carried by similar cars of equal wheel-base.

THE WINTON SALES POLICY.

As between the manufacturer who produces cars exactly alike in design and color in order to reduce production costs and the one who permits a great number of variations to suit the individual taste of the purchaser, even though the cost is greater, the Winton Company of Cleveland definitely decided some years ago to follow the latter business policy. The company's experience convinces the officials that there is a considerable and growing number of people in the cities that wish to select their cars in that manner.

PROGRESS IN MAKING SEAT COVERS.

While the better grade of seat covers that are made nowadays are both dust and water proof, Elwood Haynes, pioneer automobile builder of Kokomo, Ind., recalls that the first ones were of simple fabrics and made more for appearance than for service.

The first covers of the water proof type were made by glueing a sheet of rubber to the cloth fabric. These were all right until one attempted to remove grease spots with gasoline. The glue would dissolve and the owner would find that he had purchased two covers instead of one.

Nowadays seat covers are made of a woolen fabric which is water proofed by a compound that will not be affected by gasoline and they can be had in any variety of color treatments.

FIRST INDIANAPOLIS RACE ENTRIES.

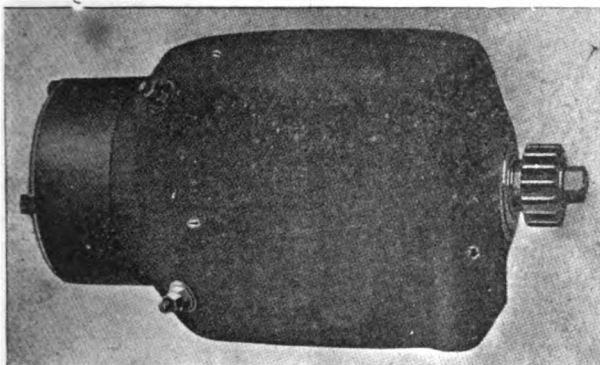
The first three official entries for the Indianapolis 300-mile race this year were made by F. S. Duesenberg for three Duesenberg cars driven by O'Donnell, Henderson and D'Alene. This team made a very good record last year for consistent work. The drivers started 30 times and took one first, three seconds, five thirds, two fourths, four fifths, two sixths, one seventh, two eighths and one ninth. The team won the Des Moines race for 300 miles at 87 miles an hour and captured a purse of \$15,000.

MOTOR STARTING AND CAR LIGHTING.

The Single and Two-Unit Disco Starting and Lighting Systems, the Characteristics of Design and the Construction and Means for Regulating Them.

CHOICE of electric starting and lighting systems are made by the manufacturers of cars upon the recommendation of their engineers, and the basis of judgment is primarily the requirements, although the market price of the automobile and the price that can consistently be paid with reference to the selling value of the vehicle is a very potent factor. There are other considerations, however, and one of these is the weight of the machine and the size of the engine that must be started, for the installation that will serve for a comparatively light car may not be equally efficient in a considerably larger and heavier vehicle.

One could not expect to have in a low or moderately priced machine the same character of



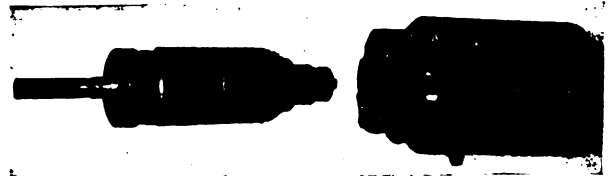
The Motor Generator for the Disco Single Unit Starting and Lighting System.

lighting and starting equipment that would be obtained in the automobile of relatively higher price, but there would be every reason to believe that the systems would be satisfactorily efficient and that there would be practically the same dependability and probably equal service so far as vehicle mileage is concerned. Not only this, many of the low priced machines are worked much harder than those of greater value, and probably the majority of owners of such cars undertake to do the minor adjusting and, in frequent instances, make all of the adjustments and such of the repairing as they have facilities and equipment to do.

Light Weight Systems for Light Cars.

With all builders of automobiles economy of fuel has been obtained through the elimination of weight without sacrifice of strength and the better conservation of power, and for this reason the manufacturers of automobiles, especially the smaller machines, have favored systems that were light, all other qualities being equal. The

single unit system may be regarded as being lighter than the two-unit system, because there is the weight of a motor and the coupling to be



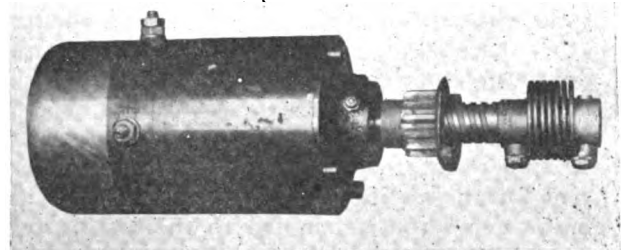
The Motor of the Disco Two-Unit Starting and Lighting System with Armature Removed.

added, although some of the two-unit generators and motors are exceedingly small as compared with their capacities.

The dependability of the systems is by no means determined, since with a motor generator the machine and its connections must function all the time the engine is running, and with the motor and generator the latter must be constantly operated, though the former is used only for starting. Used as they are designed to be used, the motor-generator is remarkably serviceable, but they cannot be expected to carry excessive loads more than momentarily, either as a motor or a generator. The same statement can be applied equally well to the motor. Continuous operation is not to be feared so much as the overloading through failure to open the switch after the engine has started to fire.

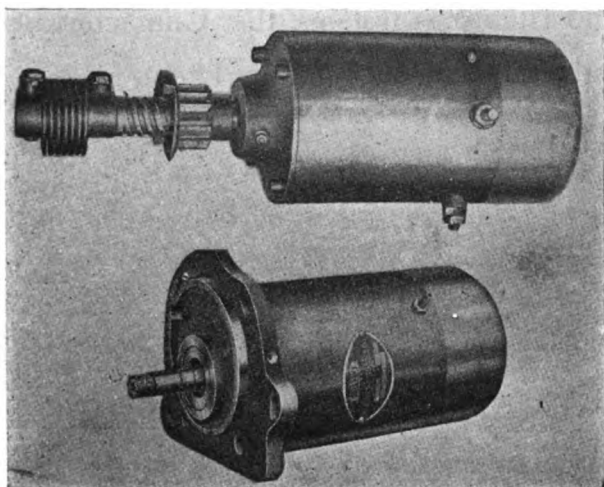
Single and Two-Unit Disco Systems.

The Disco systems, which are built by the Disco Electric Starter Corporation, Detroit, Mich., are both the single and the two-unit installations. The Disco system was, as early as 1911, made up of two machines, motor and generator, but because of the demand of the manufacturers, which assumedly reflected the requirements of their customers, the commercial production of this was discontinued and attention directed toward the building of a single unit system. This



The Motor of the Disco Two-Unit Starting and Lighting System with Bendix Drive Equipment.

system was produced exclusively until recently, when announcement was made of the resumption of the manufacture of a two-unit equipment,



The Generator and the Motor of the Disco Two-Unit Starting and Lighting System.

there being a very general demand for this type, especially for large vehicles, though the single unit is favored by the designers and builders of the lighter automobiles.

The Disco systems in principle of design and operation are conventional and do not in the main differ from the majority of those in use, but the details of construction and the proportions of the components are more or less at variance with others.

Disco Single Unit System.

The Disco single unit system consists of a combined motor-generator, a 12-volt storage battery, a combined cut-out and regulator, a combined lighting switch and dimmer, starting switch and the usual accessories. The motor-generator is built in three sizes and statement is made that this type of equipment is adaptable to any make of vehicle. The types most generally used are designated as models 26 and 28. Model 26 weighs 40 pounds and has a static torque of 35 pounds, and its efficiency as a motor is 72. Model 28 weighs 30 pounds, has a static torque of 24 pounds and its efficiency as a motor is 70. Both of these generate at 1200 revolutions a minute and operate at 12 volts pressure with a maximum amperage of 10.

The motor-generator is driven from the crankshaft and drives to the crankshaft, at a constant ratio without the use of an overrunning clutch or other disengaging equipment. It is driven from $2\frac{1}{2}$ to three times the engine crankshaft speed and generation is begun at a vehicle speed of about nine miles an hour. The battery is charged at a 10 ampere rate, which is regarded as ample current for all starting and lighting purposes. The motor-generator is coupled to the engine by a silent chain that is fully enclosed, or by gearing, as may be desired by the manufacturer, the form of coupling depending upon the design of the

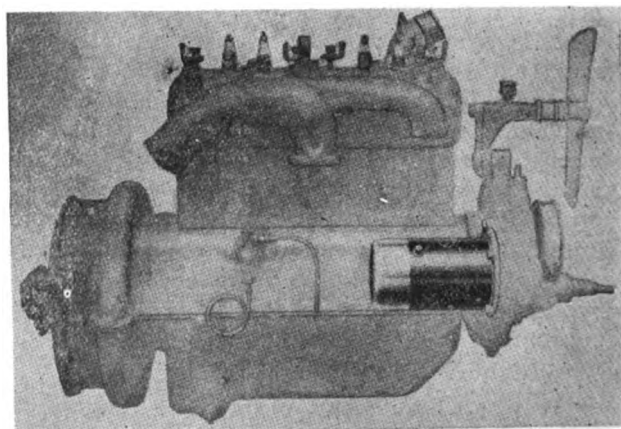
engine or the construction of the chassis frame.

The motor-generator consists of a single unit casting of sturdy design that is rectangular in form and it is so designed that one end of the casting carries the pinion end of the armature shaft. The other end of the case is a cover plate that carries the bearing of the commutator end of the armature shaft. This cover is fitted to the field frame, and the construction is such that by the removal of four screws the cover can be removed and the brush assembly and the armature can be taken out. The frame is a steel casting that is carefully machined and fitted. The armature is made with extreme care. The shaft is made of high grade steel, specially ground and adapted. On this is mounted the armature core, which consists of soft sheet iron laminae that are insulated from each other and are firmly held after assembling by end plates or collars that are securely locked under heavy pressure.

The core discs are cut to form longitudinal channels when assembled for the windings, the armature being the conventional drum type. The windings are formed of heavy copper wire, shaped on forms and carefully insulated with cotton fabric, and these are soldered to the commutator segments that are of a high grade special drawn copper. The armature is banded to thoroughly secure the winding. The armature is impregnated with an insulating compound that is baked and which will exclude all moisture and insure perfect electric conductivity. The commutator is insulated with mica. The armature is mounted in large annular ball bearings to meet the specifications of the bearing manufacturers. They are protected from dust or water by heavy felt washers.

Brushes Quickly Removable.

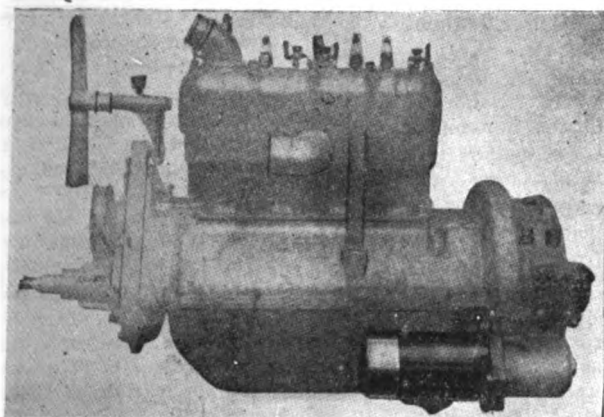
The pair of brush holders are pivoted on studs that are mounted on the cover plate at the commutator end of the generator. The brush rigging is so designed that it may be instantly



The Generator of the Disco Two-Unit System Installed for Timing Gearset Drive.

removed or the brushes themselves can be removed from the holder without removing the brush. The brushes are accessible through

large hand holes. The brushes are curved to prevent any change in the leads. One factor that is emphasized by the manufacturer is the



The Motor of the Disco Two-Unit System Installed for Flywheel Starting with Bendix Drive.

extremely small brush wear, which is due to the quality of commutation. Statement is made that the brushes used will give perfect electrical results without showing appreciable wear after 20,000 miles driving.

The motor-generators are regulated by a Ward Leonard controller that has four terminals. The principle of this is inserting a resistance in the shunt field circuit when the amperage reaches the safe maximum. The controller is mounted conveniently for examination. This instrument consists of a large electromagnet with one armature above the magnet and another below it. The contacts of the cut-out are usually held open by a coiled spring, and the regulator contacts, which are the lower, are normally held closed by a coiled spring. One of the regulator contacts is mounted on the end of the spring arm and the other end of this spring arm is secured to the lower armature of the magnet.

The current from the shunt field of the motor-generator passes through the controller terminals "B" and "C," which are shown in the accompanying diagram, and through this lower pair of contacts so long as they are closed. The total output of the generator passes around the magnet coil, and when this output reaches a certain value the lower arm is attracted to the magnet and the regulator contacts open. With the regulator contacts open the field current must pass through the resistance coil, which is mounted above the controller in some instances and at the right of the

magnet in others. While in action the regulator contacts vibrate at a high rate of speed and by continually withdrawing and inserting the resistance coil in the field circuit, maintains the generator amperage at a value determined by the tension on the regulator spring. The tension of this spring is set at the factory and is not adjustable.

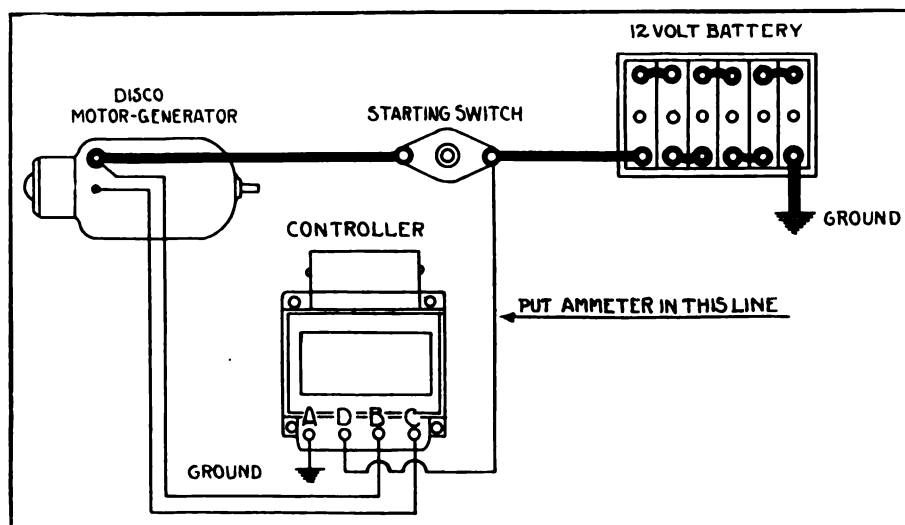
Disco Two-Unit System.

The two-unit system differs with the single-unit system in that it is constructed to operate with either six or 12 volts pressure. The standard construction may be said to be six volts, and the 12-volt system is specially built to meet the requirements of those desiring this voltage. The storage battery used is, of course, of the capacity necessary with the type of system.

The motor and the generator frames are cylindrical in form and the machines are almost identical in general appearance. The weight of these units is about 17 pounds each and the torque of the motor is approximately 12 foot-pounds, but as with the gear reduction of eight to 10 to one the power of the motor as applied to starting can be understood.

The generator is designed to begin generation at about 550 revolutions a minute and to give its maximum output at 1100 revolutions. It is geared to be driven at twice the engine speed. The only connection is a single cable that runs to the battery, the other side of the battery being grounded. The winding of the machine is such that the control is entirely automatic. The current production is governed by a cut-out that functions when the voltage pressure is sufficiently high and is continued until the speed is reduced below this point. There are no adjustments whatever and no attention is normally required, other than to lubricate the bearings.

(To Be Continued.)



The Wiring for the Control System of the Disco Single Unit Starting and Lighting System.

Studebaker Is In Exceptionally Strong Financial Position.

Company Is Said to Have One of the Best Working Capitals of Any of the Car Manufacturers.

It is reported that in support of the tremendous demand for cars now being experienced by the Studebaker Corporation, the company has at present more than \$5,000,000 in cash resources, which is after taking care of the \$2,305,000 serial notes called and paid off March 1 and after meeting the March 1 dividend. By June 1, it is confidently expected, Studebaker cash deposits will approximate \$8,000,000.

It is generally recognized that the Studebaker Corporation has one of the best working capitals of any company in the industry. On Dec. 1 it was \$21,276,000, or double the par of the outstanding preferred. There is every reason to believe that at the end of the present fiscal year, the net working capital will exceed \$25,000,000.

Shipments during the first two weeks of March have been at the rate of 6000 cars a month, or approximately 75,000 a year, as compared with 38,000 in 1915. In the recent annual report to the stockholders, the management predicted a 60,000 annual production, which indicates that if shipments continue during the year at the March rate this estimate will have been exceeded by 25 per cent.

NEW PITTSBURGH COMPANY.

The Pittsburgh Industrial Development Commission announced recently the New Wonder Oil Company of America, a \$100,000 concern, which is financed by prominent Pittsburghers, is located in a two-story concrete building at 519 General Robinson street and will begin operations immediately.

Its formation is based on the discovery of a mineral oil which is said to be the first ever produced that will assimilate with gasoline and is susceptible to an exceptionally high fire test. One quart of oil is used with a gallon of gasoline.

The officers of the new company are Joseph R. Orr, president; James C. Clow, vice president; R. E. Miles, secretary; James D. Orr, treasurer.

The company is understood to be the outgrowth of an experimental plant which was established in Detroit and was operated for many months under the direction of F. R. Hemenger and B. G. Desmond.

NEW ELECTRIC COMPANY.

The Belmont Electric Auto Company has been organized and will locate at Wyandotte, Mich., to manufacture an electric motor car of new design, the prices of the different models being given as follows: Delivery car, \$985; four-passenger model, \$1400; six-passenger limousine, \$1600. The name of the new vehicle

will be the Belmont, and it is expected that it will prove a distinct advance over the present types.

A feature will be the provision of charging plant, for \$150 additional, which will make owner independent of charging stations and will enable him to motor across the country, if he desires, without recourse to public garages.

The president of the Belmont company is J. H. Bishop, capitalist of Wyandotte. The other officers will be announced later.

LANG LEAVES SOLVAY

Currier Lang, for eight years with the Solvay Process Company, has resigned as chief of the civil engineering department to become assistant general manager of the Detroit Gear and Machine Company. Upon graduation from the Massachusetts Institute of Technology, Mr. Lang joined the engineering department of the Pennsylvania Railway company. He resigned to associate with the technical staff of the Detroit River Tunnel company for about two years and



Currier Lang, Assistant General Manager, Detroit Gear and Machine Company.

then went to the Solvay company in 1908.

The officers of the Detroit Gear company are Alexander W. Copland, president and general manager; T. H. Hinchman, vice president; William Hendrie, secretary-treasurer; Currier Lang, assistant general manager.

KELLY-SPRINGFIELD TIRE.

It is expected that the Kelly-Springfield Tire Company will this year show earnings of about 50 per cent. on the common stock. This is equal to about \$13 a share. Earnings of 29.67 per cent. were reported for 1915 and 23.15 per cent. for 1914. The par value of the common stock was recently reduced from \$100 to \$24.

Grant Motor Car Company Reports A Very Favorable Year.

Earnings for Year Were \$200,000, Equal to 6½ Per Cent. on Common and Seven on Preferred.

The Grant Motor Car Company, Findlay, O., reported recently that earnings for the year ended Jan. 31, 1916, amounted to \$200,000, which is equal to seven per cent. on the \$1,000,000 preferred stock and 6½ per cent. on the \$2,000,000 common. The company has no notes, bonds or floating indebtedness.

At present Chicago bankers are offering Grant preferred stock at around \$105, this price including one share of preferred and two shares of common. It is reported that application has been made to list the common stock on the New York City curb market and the preferred on the Chicago stock exchange.

Officers of the company report that the Grant plant is working at full capacity to meet the demand for the six-cylinder car, which is priced at \$795.

PERLMAN RIM CORPORATION

Out of the litigation which has surrounded the manufacture of demountable rims for some time has appeared the Perlman Rim Corporation, capitalized at \$10,000,000 under New York laws. This company has taken over the patent rights of Louis H. Perlman and in consequence there is expected to be no halt in the manufacture of rims for the motor vehicle industry, as was threatened a few weeks ago.

Mr. Perlman, president of the new company, makes the following statement:

"The threatened shut down of automobile production incident to the settlement of the demountable rim patents controversy has now been happily averted. The manufacture of automobiles, so far as demountable rims are concerned, will go on as usual and without pause. Infringing makers and users will be treated fairly."

The Perlman Rim Corporation, which is an independent organization and not affiliated with any of the rim manufacturing concerns, is being financed by L. G. Kaufman, president of the Chatham & Phenix National Bank of New York, who has associated with him a number of prominent and equally influential interests.

The new company has a broad charter. For a time it will confine its operations to the manufacture and sale of demountable rims of which approximately 700,000 sets will be required to meet the demands for 1916.

The Standard Welding Company, one of the largest makers of that type of rim, announces that it will continue to produce plain clincher and quick detachable rims, motor truck bands, tire bases, etc., which the Perlman patents do not cover, and which form the larger part of company's rim business.

United States Rubber Reports Sales of \$92,861,015 for Last Year.

Financial Report Shows an Increase of Approximately \$9,000,000 Over the Preceding Year.

The United States Rubber Company, New York City, reports total sales of \$92,861,015 for the year 1915, as compared with \$83,678,812 for 1914. The surplus on Dec. 31, 1915, was \$22,962,321, while at the end of the preceding year it was \$20,005,322. Profit from operations was reported as \$13,617,134; in 1914 they were given as \$12,088,469.

The detailed balance sheet as of Dec. 31 last is as follows:

ASSETS.	
Property, plant and investments, including rubber plantations	\$126,347,930.90
Inventories, manufactured goods and material.....	39,768,295.77
Cash	13,102,407.57
Notes and loans receivable	1,562,983.74
Accounts receivable.....	20,820,333.79
Securities, including stock of the U. S. Rubber Company held by subsidiary companies	2,272,430.99
Sinking fund cash in hand of trustees	476,251.32
Miscellaneous	2,200,809.32
	\$80,203,512.50
LIABILITIES.	
Capital stock, first preferred	\$59,692,100.00
Capital stock, second preferred	458,400.00
Capital stock, common.....	36,000,000.00
	\$96,150,500.00
Capital stock Rubber Goods Manufacturing Company: Preferred issued	10,351,400.00
Owned by U. S. R. Co., deposited with trustees.....	8,862,400.00
	\$1,489,000.00
Common issued	16,941,700.00
Owned by U. S. R. Co., deposited with trustees.....	16,898,400.00
	\$43,300.00
Minority Canadian Consolidated Rubber Co., Ltd., stock, preferred \$283,665, common \$206,535.....	\$490,200.00
Ten-year 6% collateral trust sinking fund gold bonds, U. S. R. Co.....	\$16,500,000.00
General Rubber Company debentures 5%.....	9,000,000.00
Ten-year 5% debentures Eureka Fire Hose Mfg. Co..	970,000.00
Forty-year 6% collateral trust gold bonds, Canadian Consolidated Rubber Company	2,597,000.00
Canadian Consolidated Rubber Company 5% debentures	2,500,000.00
Mechanical Rubber Company and New York Belting and Packing Co. bonds...	791,000.00
Morgan & Wright.....	3,000,000.00
	\$18,858,000.00
Notes and loans payable....	\$19,939,709.23
Acceptances for importation of crude rubber.....	1,135,601.08
Merchandise accounts payable	6,111,514.27

Accrued interest, taxes, etc.	494,738.92
	\$7,741,854.27
Reserved for dividends....	\$1,200,718.00
Insurance fund reserve.....	809,499.27
Employees' accident fund..	286,110.06
	\$1,095,609.33
Reserve for depreciation...	\$5,000,000.00
Fixed surpluses (subsidiary companies)	\$15,080,230.78
Surplus	\$22,962,321.79

An exceptionally large amount of crude rubber is being carried by the company, according to the statement of Col. S. P. Colt, president, which accompanied the report. This requirement of raw materials, coupled with the natural growth of the business, together with the necessity of making provision for funding the company's debt on Dec. 1, 1918, are responsible for the carrying of such a large cash surplus undistributed. Export business during the year was only five per cent. of the total business done.

The next report of the United States Rubber Company will be issued as of June 30, the directors having voted last fall to issue semi-annual statements, following demands on the part of many of the stockholders after the dropping of dividends on the common stock.

WHITE DECLARES DIVIDEND.

The White Motor Company, Cleveland, has declared an initial dividend of 1% per cent. on the capital stock, payable April 8 to stock of record March 25. It is understood that this action places the issue on a seven per cent. per annum basis, and it is semi-officially said that further distributions in the form of extras will be paid during the year, to bring the total up to 10 per cent. for the 12 months.

The present company has \$16,000,000 stock outstanding. In 1915 earnings aggregated \$8,000,000, or 50 per cent. on the stock. Profits this year are running at the rate of 30 per cent. per annum, practically all from domestic business. Par of the stock is \$50.

REPORTS LARGE PROFITS.

The J. I. Case T. M. Company, Racine, Wis., reports net profits of \$1,931,825 for the year 1915. The total income was \$2,889,282, from which was deducted \$907,457 interest and \$50,000 to form a reserve to balance losses on receivable accounts.

Preferred dividends of \$850,500 were paid, leaving the sum finally transferred to the surplus at \$1,081,325. Last year this item was reported as \$116,198.

MORE MONEY FOR CREDITORS.

The fourth dividend has been paid to creditors of the old Lozier Motor Company, they receiving checks for 7½ per cent. of their claims. The distribution is being made by the Detroit Trust Company, Detroit, Mich.

Peerless Truck and Motor Shows Net Profits of \$2,555,773.

Balance Sheet Covers Operations of Peerless Motor Car Company and General Vehicle.

For the year 1915 the Peerless Truck and Motor Corporation, Cleveland, has reported net profits of \$2,555,773 for the operations of the Peerless Motor Car Company and the General Vehicle Company, the subsidiaries. Cash on hand and marketable securities at the close of Dec. 31 amounted to \$2,881,751.

The statement is as follows:

ASSETS.

Patents, franchises and good will	\$5,100,000
Plant, buildings and equipment..	4,559,986
Land	967,154
Inventories	2,143,015
Accounts and notes receivable..	539,515
Sundry debtors	29,463
Sundry investments	18,036
Marketable securities	431,978
Cash in banks and on hand.....	2,449,773
Deferred assets	265,968

LIABILITIES.

Peerless Motor Car Co., preferred stock	\$2,100,700
Peerless Motor Car Co., common stock	2,085,500
General Vehicle Co., pfd. stock..	1,200,000
General Vehicle Co., com. stock	5,000,000
Funded debt	900,000
Special deposits	200,700
Accounts payable	1,012,308
Preferred dividend	1,505
Sundry reserves	177,074
Liabilities of subsidiary companies to Peerless Truck and Motor Corporation	135,743
Total surplus and reserves.....	2,724,734

This statement is virtually a consolidation of the balance sheets of both companies mentioned, which were merged into the Peerless Truck and Motor Corporation last fall. The current assets are given as \$5,611,780 and current liabilities as \$1,391,587, which leaves working assets of \$4,220,193.

FORM RUSSIAN TRADE COMPANY.

The International Manufacturing Sales Company has been formed, with headquarters in Chicago, to encourage the sale of American goods in Russia after the war. It hopes to represent 50 of the largest American producers, and among these will be several motor manufacturers.

A. S. Postnikoff, president of the corporation, has been in Detroit seeking arrangements with several car makers. He declared that there was an almost unlimited field for American goods in Russian markets. There is a decided sentiment in favor of buying from America rather than from Germany, and, furthermore, American goods have always been liked in Russia and have been regarded as offering exceptionally good quality for the price.

In the past 55 per cent. of the American goods imported into Russia have been sent to Germany and re-exported. This involved profits for the American

maker, the German importer and exporter, and the Russian jobber and retailer. The number of these margins will be considerably reduced by the new company.

Sales headquarters will be established in Moscow and selling branches and a large organization will be maintained throughout the empire.

ACCESSORY MAKERS PROSPEROUS.

It is reported of Gray & Davis that its regular automobile business is running far ahead of last year, and that the outlook for the 1917 fiscal year is exceedingly promising. Within the last few weeks orders have been placed with the company for 25,000 automobile starting and lighting systems for delivery in 1917, aggregating more than \$1,250,000. These systems will continue to be made in the Cambridge, Mass., plant, as the Amesbury factory is equipped especially for the manufacture of lamps and kindred appliances.

GRANT FULLY TRANSFERRED.

Grant affairs are now completely in the hands of the newly organized Grant Motor Car Corporation, a \$4,000,000 concern, the final transfer of assets of the old Grant Motor Company, Findlay, O., having been completed.

All the assets and liabilities of the old company have been taken over, and the organization remains as before. The officials are planning a production of 15,000 Grant cars during 1916.

WONDER MIST EXPANDING.

Reincorporating its business under Maine laws with \$1,500,000 capital stock, the Wonder Mist Company, Boston, Mass., is preparing for a largely increased production of its body polish. The company has bought a new factory, 110 by 44 feet and three stories high.

Owen A. Cunningham is president, Elery M. Blake vice president and Raymond M. Adams treasurer.

CAR COMPANIES CONSOLIDATE.

Under the name of the Palmer-Paine Motor Company, the Detroit Commercial Car Company and the Pontiac Chassis Company, both of Pontiac, Mich., have been consolidated. They have been occupying the same plant for some time.

R. A. Palmer, formerly manager of the Cartercar company, is president of the new concern.

REMY RE-ELECTS OFFICERS.

At the recent election of the Remy Electric Company, Detroit and Anderson, Ind., all the old officers were re-elected. S. A. Fletcher is president and H. W. Griffith is secretary, treasurer and general manager.

Big New York and Chicago Capital Backing Guaranty Securities Corporation.

New Corporation Is Capitalized on a Basis of Handling \$50,000,000 of Automobile Paper.

It is rumored that big New York City and Chicago capital is behind the newly formed Guaranty Securities Corporation, which is said to have formulated a new and original plan whereby automobile dealers handling various makes of cars can dispose of them on the time payment basis.

Several similar plans are in operation, but in each case they differ in some details and it is to offset this objectionable feature that the Guaranty corporation has entered the field with a selling plan which is declared to be uniform for all makes of cars and national in its scope.

Exact details of this plan have not yet been made public. However, it is generally conceded that this new company is destined to take an important part in the future of the motor car business, which is evident in the fact that it is capitalized on the basis of handling \$50,000,000 worth of automobile paper this year.

PARIS LEAVES DIXON.

In a notice being sent to the motor vehicle trade, the Joseph Dixon Crucible Company, Jersey City, N. J., maker of Dixon automobile lubricants, announces that Sherman B. Paris has resigned from the company's advertising department and requests that communications relative to advertising matters be sent to the company direct, rather than to an individual, even when Mr. Paris' successor has been appointed. This arrangement is with the idea of facilitating attention to all communications.

HUPP HAS NEW OFFICIAL.

J. Walter Drake, president of the Hupp Motor Car Corporation, Detroit, announces the appointment of Arthur von Schlegell as a vice president of the company. Mr. von Schlegell, well known in Detroit and throughout Michigan because of his work as general manager of the Michigan State Telephone Company, is assisting Mr. Drake in the management of the affairs of the business.

FRIED WITH PREMIER.

Ernest R. Fried, at one time connected with the engineering department of the General Motors Company and the Ferro Foundry and Machine Company, and having more recently acted as assistant chief engineer of the Fiat company, has been appointed assistant to Charles S. Crawford in the engineering department of the Premier Motor Corporation, Indianapolis. This department is located

in Detroit, in the Kresge building, for the present.

Another Premier announcement is that F. P. Nehrbas has been appointed factory production manager. He has had wide experience in his chosen field, having been with the E. R. Thomas Company in 1900, with the American Locomotive Company at Providence and the Lyons-Atlas Company, Indianapolis.

INCREASE IN RUBBER GOODS.

In the five years since 1909 the manufacture of rubber in the United States has increased 52.1 per cent. or \$102,857,189 in value. The 331 establishments engaged in this line in 1914 produced goods valued at \$300,251,827.

The production of rubber tires for 1914 was valued at \$146,411,692, and formed almost half (48.8 per cent.) of the total value of all kinds of manufactured rubber goods made during the year. There were 8,020,815 casings, valued at \$105,671,223, and 7,906,993 inner tubes, valued at \$20,098,963. Solid tires for motor and other vehicles were made to the extent of \$13,735,681. Bicycle and aeroplane tires amounted to 3,728,138 and were valued at \$6,905,852. Next to tires, rubber footwear was the most important product.

FORD FIGHTS CALIFORNIA LAW.

The State of California under a new law attempted to collect \$24,000 in franchise taxes from the Ford Motor Company on pain of rescinding the privilege of that company to do business there. The company refused to pay the tax and applied to the United States district court for an injunction against the enforcement of the law. This was granted. The right of the state to impose such taxes on foreign corporations is to be tested.

FIRESTONE PROMOTES MANLEY.

The Firestone Tire and Rubber Company, Akron, O., announces the promotion of A. L. Manley from branch manager at Buffalo, N. Y., to manager of the branch at Newark, N. J. He also has been given charge of the export business of the company handled from Newark.

BAYLESS GOES TO CHAMPION.

B. H. Bayless, formerly in charge of advertising for the Berdan & Co., Toledo, has joined the Champion Spark Plug Company as assistant to H. L. Corey, advertising manager.

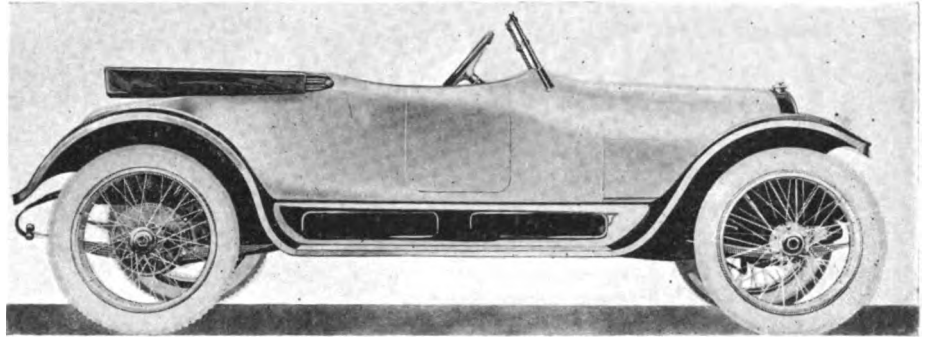
T. S. Gamble, former assistant advertising manager of the White Company, has joined the Maxwell Motor Company, Detroit, as assistant to Advertising Manager Coburn.

A. A. Bull, for some time assistant chief engineer of the Cole Motor Car Company, Indianapolis, has resigned.

OVERLAND SIX NOW CARRIES CLOVERLEAF ROADSTER BODY

TO ITS already distinctive and comprehensive line of chassis and bodies the Willys-Overland Company, Toledo, O., has added a six-cylinder cloverleaf roadster at a price of \$1250. The body is the product of the Ohio Electric Car Company, which is favorably known for its excellent coach work, while the chassis is the very well liked 45 horsepower Overland model 86.

This combination of the resources of two large and leading makers in their respective lines assures a "job" far above the average for this type of car and for the price. It is explained that the body work has been taken up by the Ohio com-



Side View of Overland 45-Horsepower Cloverleaf Roadster, Which Sells for \$1250.

The body is extremely comfortable and carries four persons, two on individual seats in front and two on a seat in the rear compartment. Both compartments are reached by an aisleway, as is shown in one of the accompanying illustrations.

The design is exceedingly attractive, the long, sweeping fenders giving a grace to the whole outline, and the sloping windshield adding to the suggestiveness of speed. As in other Overland

products the upholstery is deep and soft, the seats and backs being set at a most restful angle, and there is ample leg room in both compartments.

Riding comfort is further assured by the long underslung rear springs of the Overland 86 chassis, the long wheelbase of 125 inches, and the large tires, not to mention the smoothly operating six-cylinder motor, the drop frame which carries the weight low and minimizes side-sway, and the location of the transmission on the rear axle to obtain an even distribution of weight.

EXPORT RECORDS BROKEN.

Figures for American exports for the past year show that those of motor vehicles amounted to \$94,879,738 and now ranked fifth in the different classifications of goods shipped from the United States.

The increase in motor exports amounted to 232 per cent. over the year before, when they aggregated \$28,507,464. The passenger cars shipped during 1914 totaled 22,333, valued at \$19,521,708, and in 1915, 41,869, valued at \$35,045,492. The trucks increased from 4430, worth \$8,985,756, to 22,082, valued at \$59,834,246.

The following table shows where the shipments went:

Country	Number	Value
United Kingdom.....	24,355	\$35,053,097
France	6,304	15,922,313
Other Europe.....	8,630	22,330,357
Canada	5,796	4,622,931
British Oceania.....	4,818	4,075,299
Asia and other Oceania	4,319	6,728,813

SALES AFTER THE WAR.

There are strong indications that the light, quantity made car of good quality, in whose manufacture no other country can compete with the United States, will find a large sale in Europe after the war is over. A letter was recently received from Germany offering the Olds Motor Works spot cash for 50 of its cars to be kept in storage ready for instant shipment at the close of hostilities. Conditions will be much the same elsewhere in Europe and a large sale of American light cars is regarded as sure.

The Pathfinder dealers in Chicago, J. R. Emery & Co., have arranged to run a special train from Chicago to Indianapolis with Pathfinder owners to enable them to investigate the factory's facilities.

Chassis Details of the New Overland Cloverleaf Roadster.

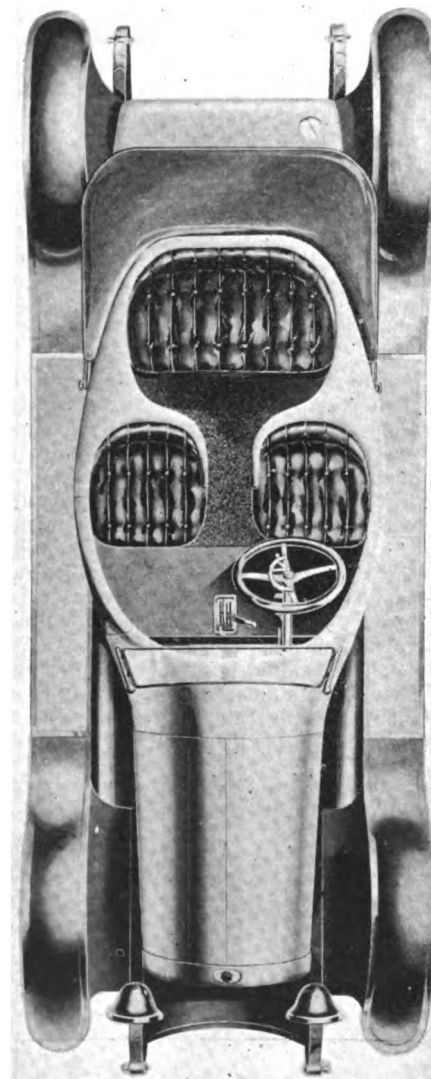
Make of motor.....	Continental
Shape and cast.....	L-En Bloc
Cylinders	Six
Bore and stroke.....	3½ by 5¼
Horsepower	45
Piston displacement.....	303.1
Cooling system....	Circulating pump
Lubrication	Pressure-splash
Ignition	Single-magneto
Ignition, make, control..	Split-hand
Carburetor.....	Improved hot air
Starting and lighting....	Auto-Lite
Clutch	Cone
Gearset	Selective-three
Wheelbase.....	125 inches
Wheels	Wood
Rear springs.....	¾ elliptic
Steering and control..	Left, centre
Rear axle.....	Full floating
Price.	

Cloverleaf Roadster, 4 pas...\$1250

pany because of the excellence of its organization and so as not to introduce any element that would have the slightest possibility of disarranging the present production schedule of the Overland plant.

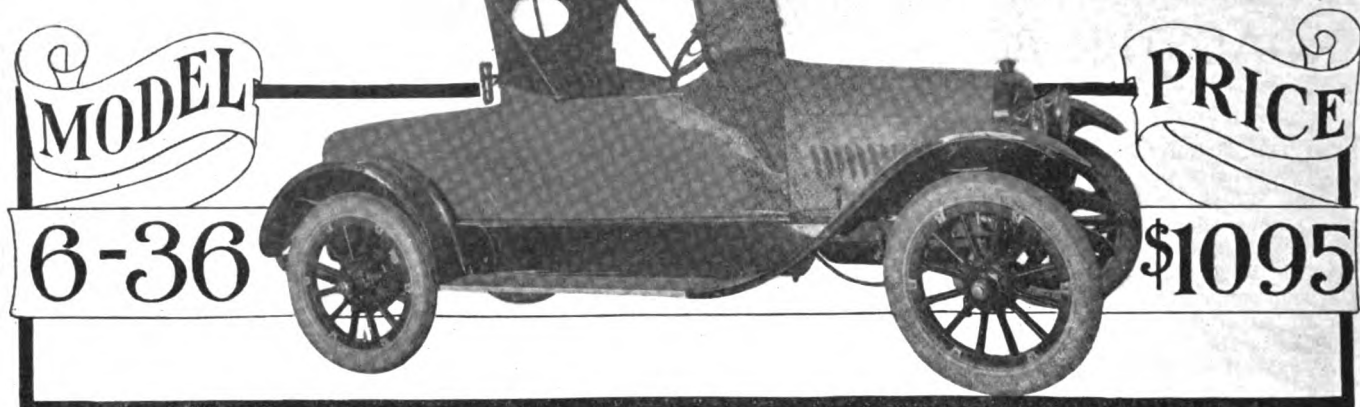
Overland dealers have been instructed that orders for the chassis of this car are placed with the Willys-Overland Company, with instructions to deliver to the Ohio Electric Car Company, with whom the order for the body is placed. Settlement for the body is made direct to the Ohio company.

The cloverleaf body is furnished with the option of four color combinations: Battleship gray body, light gray wheels; bright green body, straw color wheels; vermilion red body and wheels; Yale blue body, light gray wheels. Fenders and trimmings are finished in black enamel.



Interior of the Overland Cloverleaf Body—Dimensions: Rear Seat, 35 Inches Wide, 17 Deep; Front Seat, 19 Wide and 17 Deep; Space Between Front Seats, 8 Inches; from Front Seat to Dash, 19½; from Front of Rear Seat to Back of Front Seat, 12 Inches.

The NEW SIX-CYLINDER KLINE KAR



IN DESIGNING and constructing its series E six-cylinder Kline Kars for 1916 the Kline Car Corporation of Richmond, Va., has drawn upon the best of American and European motor car practice and has evolved cars that are exceptionally attractive and serviceable. The company's own experience in motor car construction in past years has enabled it to produce the best model it has ever placed on the market. In addition to making material reductions in price the cars offer more value for the money.

Appearance Is High Grade.

Kline Kars have the low hung, racy appearance of the high-grade European machines which not only give distinctiveness, but is directly responsible for their steady and comfortable riding qualities. The series includes a five-passenger touring and a two-passenger roadster car, both selling for \$1095, and mounted on a six-cylinder chassis. The first named weighs about 2675 pounds, while the roadster weighs about 2600. They both develop from two to 55 miles per hour on high gear and have 38 horsepower at 2000 revolutions.

The motor is a Continental production, an L head block casting with six cylinders of 3¼-inch bore and 4½-inch stroke. The cylinder head is cast separately and is easily removable, while the crank case and the oil pan are also separate units. The power plant is a unit and is suspended at four points mounted on brackets supported by the main frame.

The crankshaft is carried on three bearings, the front bearing having flanges at both ends to take any end thrust that may be imparted from the clutch or some outside mechanism. Access to the bearings is had through removal of the oil pan.

The crank case is of pressed steel, which is several pounds lighter than the cast aluminum type.

All valves are enclosed and are mechanically operated on the right hand side of the motor on one camshaft, which is drop forged and runs in bronze backed babbitt lined bearings and is lubricated by the oil that collects in the oil pockets cast in the crank case for that purpose. The inlet and exhaust valves are interchangeable and have nickel steel heads electrically welded to carbon steel stems. There is a patented valve locking device which is very simple and easily detached. Timing gears are helically cut.

Hot Air Attachment.

The carburetor is a Rayfield automatic float feed type with hot air attachment. Fuel feed is by gravity through vacuum system from a 15-gallon gasoline tank suspended from extensions of the main frame members on the rear and equipped with a gauge registering the quantity.

The exhaust manifold is carried on the right hand side of the motor, and is cast separately. It is so mounted as to provide maximum ease in adjusting valves, springs, etc.

The cooling system includes a V shaped cellular radiator, a ball bearing mounted and belt driven fan with belt tightening device, and a centrifugal

pump to circulate the water. The pump is fitted with two extra large bearings, which have stuffing boxes, and is equipped with a drain cock so that water can be drawn off during freezing weather.

Efficient Lubrication System.

Lubrication is by the combination force feed and splash system. A horizontal plunger pump, driven by an eccentric from the camshaft, forces oil through copper tubes direct to the timing gears and to the main bearings and through the indicator on the cowl board. It then drains back into the oil pan, thus maintaining a proper level for the splash lubrication of the pistons, connecting rods and push rod mechanism. There is provision for draining the oil and the strainer can be removed easily for cleaning purposes.

Ignition is by the Westinghouse vertical system mounted on the generator and driven from the main shaft of the same by gears. The single spark is very hot. Control is by hand.

The lighting system is a Westinghouse product and is driven through the pump shaft at 1½ times the speed of the crank shaft. The generator is mounted on the valve side of the motor. The current it generates to keep the battery charged is registered on the ammeter, which is placed on the cowl board.

The starting motor is also made by the Westinghouse Company and is mounted on the left hand side of the motor on a bracket bolted to the base and is kept in line by there being a flange cast integral with the starting motor and bolted to the power plant housing. The drive is through Bendix transmission, entirely enclosed.

A multiple dry disc clutch has been



The Kline Kar Touring Model, a Six-Cylinder Medium Weight Car with Capacity for Five Passengers.

adopted. It is lined with heat resisting non-burnable facing.

The transmission gearset is of the unit type selective, three speeds forward and reverse. The gears are of heat treated alloy steel, as is the drive shaft. This shaft is round and $1\frac{1}{4}$ inches in diameter, one end being fitted by taper to the rear universal joint and the other end being squared for sliding in and out to take up the lengthening and shortening of the springs. The joints are attached to the rear axle end and the transmission on tapered standard fittings.

Brown-Lipe Differential.

The rear axle is a three-quarter floating type with pressed steel bridged type housing, and has roller bearings. The differential proper is the Brown-Lipe helical bevel gear type. The hubs are carried on adjustable roller bearings, and the double brakes—two internal and two external—are of the expanding and contracting type and adjustable.

The front axle is an I beam section with spring pad forged integral and fitted with Elliott type steering knuckles and bushed to prevent wear as well as to give accessibility when renewing.

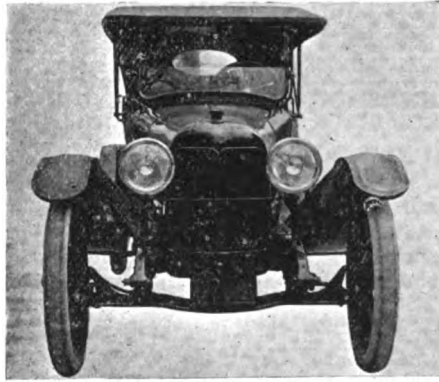
The rear springs are three-quarter scroll elliptic underslung, while the front are semi-elliptic. The wheels are wood artillery type with interlocking spokes to insure maximum strength. The rims are the Firestone split demountable type, one extra being supplied with the car. The tires are 34 by four inches, plain in front and non-skid in the rear.

The wheelbase is 120 inches, the tread 56 and the clearance 11 inches.

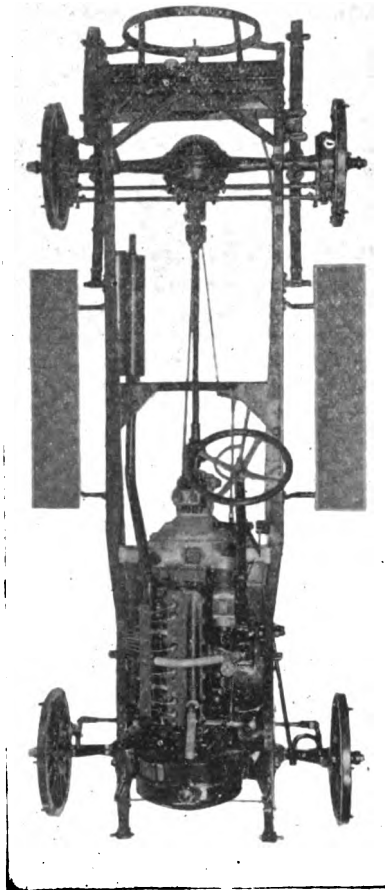
The body is a Kline special design, yacht type, tapering from front to rear with a gradual sweep on the top lines, and curved in at the sides, forming a plain door and panels, and giving a very smooth finish. It is made of wood and steel construction reinforced by ironing and fitted with concealed top irons.

The windshield is supported on concealed brackets, which gives the assembly the appearance of a built-in construction. The doors are of the wide U pattern, and both touring and roadster bodies have ample tool compartments under the front seats. The roadster also has a package compartment in the rear deck, entrance to it being from the side.

Straight grain, semi-bright finish leather, with curled hair for tufting and coil springs in backs and cushions, is used for upholstery. Both the back of



Front View of the Kline Kar, Showing Sweeping Lines of Body.



The stripped Chassis of the Kline Kar Model 6-36, Which is Curved Over Rear Axle to Obtain Low Centre of Gravity.

the front seat and the cowl board are upholstered and have a distinctive appearance. The doors have large pockets.

The top is a four-bow, one-man construction, and is fitted with quick adjustable curtains which are operated from the inside.

Equipment Is Very Complete.

Equipment includes top and curtains, rain vision ventilating two-piece windshield, tire irons on rear, extra rim, trouble lamp, speedometer, Klaxet horn, foot and robe rails, tool kit and jack.

The touring car will seat five persons comfortably, while the roadster will accommodate two ordinarily and three in emergencies. The standard colors are dark green body and hood, black radiator, fenders and chassis and medium red wheels. The Kline company gives an option on other color combinations at an increased price and subject to delays.

HILL CLIMBING TEST.

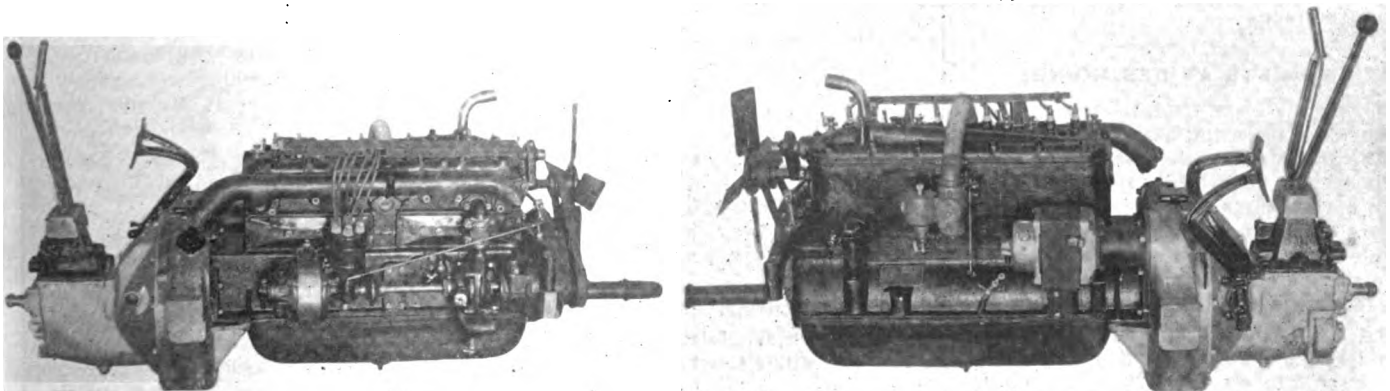
To test the hill climbing abilities of the Chalmers Six-30 touring car, one containing four passengers, recently climbed Mt. Hamilton to the Lick observatory under very unusual conditions.

The fan and fan belt were removed entirely from the car and the gears were locked in high. At the top of the climb a San Jose notary public, who later made an affidavit regarding the trip, tested the water in the radiator and found it luke warm.

The average grade to the summit is seven per cent. and for considerable stretches it reaches 10 to 15 per cent. Winter blizzards and rains had washed away the road in spots, making the trip exceptionally difficult. It is two miles to the top of the mountain by air line, but seven by road. There are 365 turns and many of them are very sharp.

PRESIDENT TO AID SALESMEN.

In response to an urgent invitation given by Harry W. Ford, president of the Saxon Motor Car Company, who made a trip to Washington for the purpose, President Wilson has expressed a desire to open the World's Salesmanship Congress in Detroit in June, or if he cannot be there at the opening, to come on some other day and address the meeting. He promised to attend unless something should prevent him at the last moment.



Views Showing Both Sides of the Kline-Continental Six-Cylinder L Head Motor, Which Develops 38 Horsepower at 2000 Revolutions and Propels the Car at a Rate of from Two to 55 Miles on High Gear.

FOUR RACES AT SHEEPSHEAD BAY.

Racing Season this Year to Be a Succession of Brilliant Motor Contests---Many Foreign Drivers to Compete.

Plans for the opening meet on the Sheepshead Bay speedway, May 13, call for four events. The most conspicuous will be a race for the Metropolitan trophy, which will be contested for for three or five years before final possession can be secured. The length of the race will be 150 miles for cars of 300-inch piston displacement or less. The drivers will have to make 90 miles an hour to qualify and the length of the race will be limited to 90 minutes.

This event will be regarded as a championship race by the American Automobile Association and will count in determining the championship for the year, as the association will do under its new plan. Prizes for the race will amount to \$15,000, divided into seven places from \$6000 to \$400.

The other events will be a 50-mile Queens cup race for which \$2500 will be awarded in five prizes; the 20-mile Coney Island cup with \$1500 for five places, and the 10-mile Brooklyn handicap for non-winners, the prize being the William Kemble cup and \$1000. Anyone who does not take a prize in the three previous races can compete in this event. Another feature that may be arranged for the opening day is a 10-mile match race between the three fastest cars in the world.

HARKNESS BUYS DELAGES.

Harry S. Harkness has purchased the three Delage cars that were driven by Duray, Bablot and Guyot in the French Grand Prix race of 1914. They have arrived in New York and are now being overhauled for the first race of the season. Carl Limberg will be the captain of the team.

The motors are unusual in that the valves are both opened and closed mechanically without the action of springs. In the Grand Prix the cars did not do very well, but they had shown great speed in some of the preliminary trials. The reason for their indifferent showing in the big event is said to have been that some maladjustment was made the night before the race.

FOUR MEETS AT DES MOINES.

Four days of racing have been planned for the Des Moines speedway. The first of these will be held on Memorial Day, when entries in the meet will be limited to cars owned in Iowa. There will be a 20-mile Iowa derby limited to cars of that state and a 10-mile race with entries limited to cars owned in Des Moines.

The big event of the year will be the 300-mile race similar to that of last year. It will be run on June 28. The purse will be \$10,000; there will be a technical

committee to examine the cars and drivers, and elimination trials will sift out the slow ones. A non-competitive programme will be staged at the speedway July 4.

The season will be ended by an invitation meet Labor Day, Sept. 4. The entries will be limited to six and invitations will be extended only to drivers who have finished first or second in the major speedway events of the 1916 season.

SOUTH AMERICAN RACES.

E. A. Moross, a racing promoter, believes that South America is ready for motor racing and he will take a team of American drivers there in a few months. They will go by way of Cuba and Panama.

CHEVROLET BUILDS RACERS.

Louis Chevrolet has completed the experiments he was making last fall with an aluminum engine and is now putting the finishing touches to three racing cars made entirely to his own designs. They

will be known as "Frontenacs" and will be driven by the three Chevrolet brothers, Louis, Arthur and Gaston. One is expected to be ready early in May and will be seen first in the Sheepshead Bay races. The other two will compete in the Indianapolis run. Chevrolet expects the motor which he has designed will yield 125 horsepower, although coming within the 300-inch piston displacement limit.

CHICAGO AMATEURS RACE.

A race for Chicago amateurs will be held on the Chicago speedway May 20. So many entries have been received that elimination trials are to be held and only those cars that succeed in reaching 70 miles per hour will be entered.

DISBROW IN CLEVELAND.

Louis Disbrow, well known as a racing driver, has quit that profession to sell automobiles. Recently the Louis Disbrow Motor Car Sales Company was formed with a capital of \$25,000 to sell Marmon cars in Cleveland and several counties in Ohio.

Disbrow is president of the company and is backed by the Hannas. M. A. Hanna, grandson of the famous politician of that name, is vice president, and Dan R. Hanna, the present custodian of the family's millions, is treasurer. Fred Garbien is secretary.

RACING SCHEDULE FOR 1916.

The following dates have been assigned by the contest board of the American Automobile Association for automobile contests during the coming season. Those marked * have been assigned official sanction numbers and the other dates are tentative pending completion of the preliminary requirements under the contest rules:

- | | |
|--|---|
| April 8—Boulevard race, Corona, Cal.; Citrus Belt Racing Association. | Aug. 5—Speedway, Tacoma; Tacoma Speedway Association. |
| May 6—Speedway, Sioux City; Sioux City Speedway Association. | Aug. 11-12—Hill climb, Pikes Peak, Col.; Pikes Peak Auto Highway Company. |
| May 13—Speedway, New York; Sheepshead Bay Speedway Corporation. | Aug. 12—Track, Portland, Ore., Reigel-Hiller Company. |
| *May 20—Speedway, Chicago (non-professional); Speedway Park Association. | Aug. 18-19—Elgin road races; Chicago Auto Club. |
| *May 30—Speedway, Indianapolis; Indianapolis Motor Speedway. | Sept. 4—Speedway, Indianapolis; Indianapolis Motor Speedway. |
| May 30—Speedway, Tacoma (local); Tacoma Speedway Association. | Sept. 4—Speedway, Des Moines; Prince Speedway Company. |
| May 30—Speedway, Minneapolis (local); Twin-City Motor Speedway Company. | Sept. 4-5—Track, Spokane, Wash.; Inland Auto Association. |
| *June 10—Speedway, Chicago; Speedway Park Association. | Sept. 16—Speedway, Providence; Narragansett Park Speedway. |
| June 28—Speedway, Des Moines; Prince Speedway Company. | Sept. 29—Track, Trenton, N. J.; Interstate fair (Horace P. Murphy, racing secretary). |
| July 4—Speedway, Minneapolis; Twin-City Motor Speedway Company. | Sept. 30—Speedway, New York; Sheepshead Bay Speedway Corporation. |
| July 4—Track, Spokane, Couer D'Alene; Reigel-Hiller Company. | Oct. 7—Speedway, Omaha; Omaha Auto Speedway. |
| July 4—Speedway, Sioux City; Sioux City Speedway Association. | Oct. 14—Speedway, Chicago; Speedway Park Association. |
| July 15—Speedway, Omaha; Omaha Auto Speedway. | Oct. 19—Speedway, Indianapolis; Indianapolis Motor Speedway. |
| July 15—Track, North Yakima, Wash; Reigel-Hiller Company. | |

PRACTICAL SUGGESTIONS FOR MOTOR CAR OWNERS.

Hints that Make for Economical Maintenance and Operation of Motor Vehicles, and How to Construct Practical Tools and Equipment at Home at Minimum Cost.

DAZZLING HEADLIGHTS.

Dazzle in its strictest sense means to confuse and bewilder. Dazzling head-

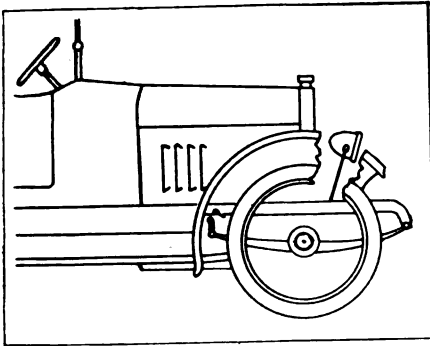


Fig. 157—A Simple Method for Tilting Lamps to Overcome Glare.

lights are therefor those which confuse and bewilder oncoming traffic. Practically every state in the Union is considering bills to eliminate such lights from the public highways. There are many appliances now on the market which eliminate glare, but it is interesting to note some of the home methods used by motorists in states which already forbid glaring headlights.

A simple, yet effective method is illustrated in Fig. 157. It consists of tilting the lamp brackets in a forward direction. This can be accomplished by using two large monkey wrenches. The bending must be done gradually, as cold metal is apt to break under a sudden strain. By tilting the brackets the glare can be cast nearer the ground without forfeiting any of the light volume.

Another method is to coat the lens with a transparent paint. Still another is to smear the lens with moistened soap. The soap film should be applied to the inner surface of the lens so that it will not be washed off by rain or rubbed off by handling.

Some motorists place a piece of paper over the upper half of the lens. The type of reflector used must determine whether the paper be pasted across the upper or lower half of the lens.

BLACKENING BRASS PARTS.

It is sometimes desirable to blacken brass parts of a motor vehicle, and this can be done easily at home. Roughen the part with fine emery cloth and apply a priming of white lead. When thoroughly dry the coating of black should be applied. If a second coat is desired simply apply on the first when dry. When both are thoroughly dry, and not before, give the whole surface two coats of varnish.

VALVE GRINDING HINT.

Valve grinding becomes a tedious operation when it is necessary to remove the wrench each time it is desired to reseal the valve. A simple spiral spring used under the head as shown in Fig. 158, will eliminate this condition. The stem is inserted through the spring, which should be of sufficient length to raise the valve from its seat. When the pressure is released from the grinding wrench the valve will be raised and can be turned to a new position without being handled by the operator.

FIRST AID SUGGESTIONS.

Accidents happen in practically every repair shop and while at first sight they may seem to be of slight consequence, if neglected serious complications may result. Simple remedies should always be kept on hand.

Burns and scalds occur frequently. These can best be treated with a mixture of lime water and linseed oil in equal

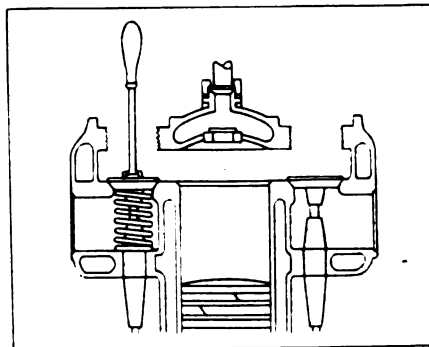


Fig. 158—Using a Spiral Spring to Facilitate Valve Grinding.

proportions. If the burn has produced a raw surface a good, though somewhat painful, remedy is to apply a strong solution of washing soda. Plain lubricating oil is often beneficial. Under no condition should cold metal or cold water be applied.

Bleeding from small cuts may be stopped by placing the wounded part in running cold water. Next draw the edges of the wound together and bind with a piece of court plaster. Lacerated wounds should be dressed with a piece of clean waste soaked in a weak carbolic acid solution and then covered with a piece of oiled silk.

A bruise may be relieved by the use of arnica lotion. If the part has a tendency to swell, it should be held so as to discourage the flow of blood towards it.

A good varnish for automobile electric terminals can be made by dissolving sealing wax in gasoline. Linseed oil should be added to prevent brittleness.

INCREASING COMPRESSION.

Many inquiries have been received from time to time as to how the compression in a motor can be increased. It is never advisable to attempt this without first consulting the manufacturer. If higher compression is advised, it can be produced by attaching aluminum plates to the heads of the pistons. This method is illustrated in Fig. 159.

Machine an aluminum plate which is $\frac{1}{4}$ inch in thickness so that it will be slightly less in diameter than the piston head. Five $\frac{1}{4}$ -inch holes should be drilled and countersunk, and a corresponding number drilled and tapped in the heads of the pistons. The plates are secured by flat head screws. Be sure that the heads of the screws are flush with the surface. To prevent them from working out the ends should be riveted over.

Graphite should be applied to the screw threads, as it is imperative that no compression be allowed to work by. The increased weight of the plates is but trifling.

CLEANING MACHINE PARTS.

Machinery and parts can be cleaned satisfactorily without the use of benzine or benzol by boiling the parts in soda lye. After removing the parts from the bath, and while the lye is still hot, thoroughly brush and then rinse in hot water. Caustic soda is said to be better than ordinary soda, because it dissolves grease and fat quicker. To dry the hot parts it is generally necessary only to allow the remaining particles of water to evaporate.

DRILLING HARD STEEL.

A simple preparation which is said to permit the drilling of hard steels used in automobile construction is made by mixing one part spirits of camphor and four parts of turpentine. It should be applied to the surface and allowed to dry. An ordinary drill may be used.

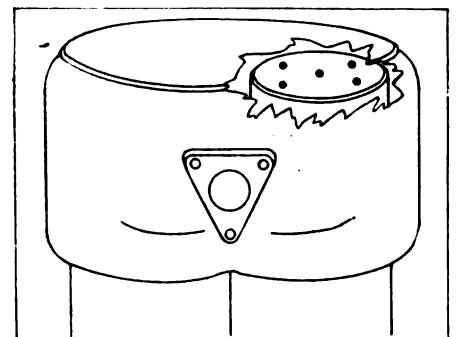


Fig. 159—A Practical Suggestion for Increasing the Compression.

DRILLING HINT.

Very often when starting to drill a hole the cutting takes place some dis-

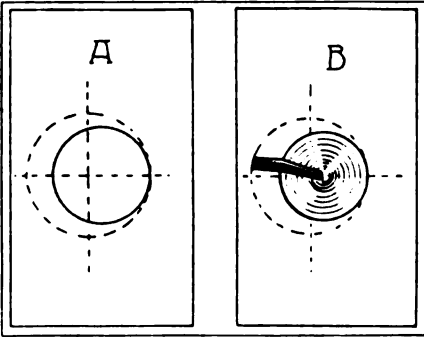


Fig. 160—How to Facilitate the Drilling of Hard Metal.

tance from the dead centre point where the hole is required. With care the tool very often can be made to cut at the desired spot by the operation which is known to the machinist as drawing. It consists of cutting a groove in the side of the depression already cut and in the direction to which it is required to draw. In Fig. 160-A, is shown a depression which if fully drilled would not be in the desired position. In Fig. 160-B, is shown the location of a groove which will draw the drill to the desired position. If the edge of the tool is below the surface of the metal, drawing is impossible.

Slow tire leaks may be the result of the displacement of the small rubber cushion in the bottom of a tire valve, which is apt to depress the core system.

HEATING BABBITT.

One of the greatest mistakes made by the inexperienced workman when attempting to babbitt bearings, is to heat the metal too much before pouring. It is ready for pouring when it is sufficiently hot to light a small pine stick. Never allow the metal to become red, which is an indication that it is overheated. Burnt babbitt will crystallize and when poured is brittle and hard; it cannot be restored even by mixing it with good. The mixture will be brittle.

CARE OF SPRINGS.

To insure against excessive spring the motorist should tighten the shackle bolts. A spring allowed to shift on the axle will cause the center bolt of the spring to become sheered off. Annoying squeaks can often be eliminated by lubricating the bolts which pass through the eyes of the springs.

LIGHTING HINT.

It often happens when making a tour through unsettled districts that at nightfall the operator has no matches with which to light the acetylene and oil lamps. To proceed on a poorly lighted and unfamiliar road under these conditions would be dangerous. Fig. 161 shows a way to obtain a flame without the use of a match.

Remove a cable from one of the spark plugs and start the motor. Roll a piece of paper and dip one end of it into the gasoline in the storage tank. By holding the terminal of the cable close to any metal part of the motor a spark is made to leap the gap. The saturated end of the paper is placed near the spark and the gasoline will instantly ignite. Care should be taken to instantly withdraw the flame from the machine.

OIL CIRCULATION.

This is the time of the year at which the operator will have difficulty in seeing the oil flow through the sight indicator on the dash, if the car is so equipped. The reason for this is that a film will adhere to the cold glass. When this condition exists it is almost impossible for the driver to see the oil flowing, but a simple and reliable method is to place the ends of the fingers on the glass. If the glass is a trifle warm it is proof that the circulation of the oil is not impeded. If the circulation was stopped the glass would be cold.

HOME-MADE VISE.

A simple home-made vise, which is valuable equipment in any private ga-

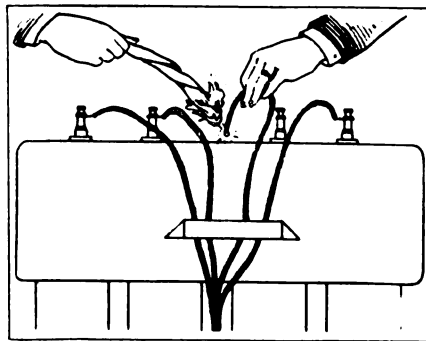


Fig. 161—How to Secure a Light from Spark Plugs.

rage, is illustrated in Fig. 162. It consists of two pieces of wood cut to the shape shown at A. A $\frac{3}{8}$ -inch hole is then drilled to receive a common carriage bolt. The two parts are joined by a hinge at the bottom.

Fasten the vise to the edge of the work bench with a long wood screw inserted through one piece. To insure long service the wooden jaws should be faced with soft copper. The operation of the tool is simple. It is controlled by tightening and loosening the nut on the carriage bolt as illustrated at B.

LAPPING MIXTURE.

When it is desired to use emery for lapping purposes, it should be prepared by filling a half pint bottle with seven parts of machine oil and one part of flour emery by bulk. Mix thoroughly and then allow to stand for about 20 minutes. Next pour off about half the contents, taking care not to disturb the emery which has settled at the bottom of the bottle. The portion drained off contains only the finest emery and will not scratch.

COLORING BRASS.

Brass articles may be finished in an attractive black by the following process: In 1000 parts of ammonia water dissolve 45 parts of natural malachite. Thoroughly clean the part to be colored and immerse in the solution for a short period. Gradually warm the solution and at short intervals examine the part to ascertain if the color be correct. The parts should then be rinsed with clean water and dried.

MAT ALUMINUM.

Aluminum articles may be given the appearance of mat silver by plunging the part into a mixture composed of a 10 per cent. solution of caustic soda saturated with ordinary table salt. Allow it to remain between 15 and 20 seconds, then wash and brush. The article should then be replaced in the bath for about 30 seconds, after which it should be washed and dried in sawdust.

NON-POROUS CORKS.

Ordinary cheap corks are porous but they may be easily made gas and airtight by immersing them in hot melted paraffine. Keep them well covered for about five minutes, after which they can be removed and placed on a screen to dry.

RENEWING ASBESTOS CASKETS.

Frequently when overhauling a foreign made car, the repairman will find copper-asbestos gaskets of odd size. When they have been in use for a considerable period they will have become hard and apparently unfit for further service. If new ones cannot be easily obtained the following suggestion may prove helpful: Hold the gasket over a flame for a few minutes. The heat will remove the old hardened lubricant and also soften the copper.

STARTING FROZEN CAPS.

When preparing to grind in the valves, one often encounters difficulty in starting the caps. This condition is especially true if shellac has been used on the threads to insure a tight joint. When additional leverage on the wrench fails to start them, start the motor and allow the engine to warm. The heat will cause the metal to expand. Then pour a little

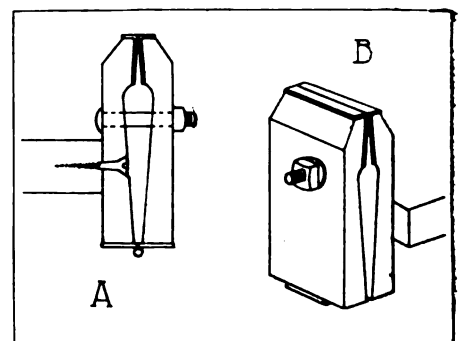


Fig. 162—A Practical Home-Made Vise.

cold water in the recess of the cap. This will cause the cap to contract sufficiently so that it can be easily moved. When replacing the cap coat the threads with graphite.

NON-SKID CHAINS.

When fitting anti-skid chains to the tires it is advisable not to attach them too tightly. When held in a fixed position, they are apt to cause excessive wear on the tire. If the chains are slightly loose, they will work around to different positions and will do no injury to the tread.

BRIGHTENING LEATHER.

A very satisfactory method of brightening leather upholstery is to rub it well with a cloth sponge that has been dipped in the white of an egg. The egg should be well beaten to prevent it becoming stringy. A dry, soft cloth should be used for the final rubbing.

SPRING LEAF SPREADER.

Any person handy with tools can make the spring leaf spreader illustrated in Fig. 164. It consists of a piece of $\frac{3}{4}$ -inch square steel which is bent to the shape shown at A. The lever consists of a steel bar $\frac{1}{4}$ inch thick and one inch wide. The end of this is ground to a taper. The lever is then bolted to the bracket.

The application of the tool is shown at B. By pulling the lever so that it is in alignment with the bracket, the tapered end is forced between the spring leaves. A good method of applying the lubricant is to coat both sides of an old table knife with the lubricant and then insert it between the spread leaves.

EASILY MADE SHELVES.

Two shelves which will be suitable for holding small parts in the garage can be easily made from a small packing case. A line should be drawn at the ends of the box from opposite corners. By sawing through these lines, two shelves, as shown in Fig. 163 will be produced. They can either be placed in the position as shown at A or inverted as shown at B.

VALVE TOOL.

The tool for lifting valve springs shown in Fig. 165, is made from a discarded

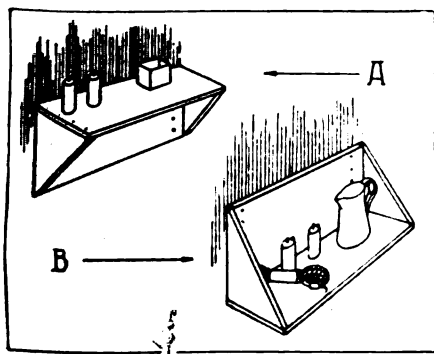


Fig. 163—How to Construct Two Practical Garage Shelves Out of a Box.

forked lever such as is commonly used for operating the brakes. The forked end was ground to form a point and about an inch above the rod was flattened and a small hole drilled through. A steel rod was then bent to a hook shape and one end was inserted in the hole. The other end was filed to a point. For convenience of operation a file handle can be fitted to the end of the tool.

SLIPPING FAN BELT.

When the fan is driven by a belt, the operator should occasionally inspect the latter and if necessary adjust it to avoid slipping. The radiation of a motor is calculated on the basis of a certain volume of air passing over the radiating surfaces. If this supply of air is decreased, because of the failure of the fan to revolve, overheating is apt to be the result.

COOLING HINT.

During this time of the year, the motorist will frequently encounter roads which are in such wretched condition that only

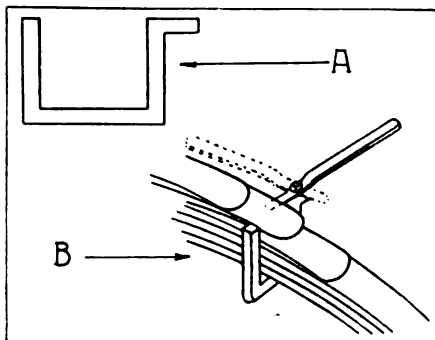


Fig. 164—The Construction and Use of a Spring Leaf Spreader.

the intermediate or low speeds can be used. Operation under these conditions soon causes overheating of the cooling system. An excellent plan is to remove the radiator cap before steam is generated, as by so doing considerable water will be saved. When the cap is left on, the steam will displace a certain amount of the water and force it out through the radiator overflow pipe. If the cap is taken off, there is an open channel for the escape of the steam and the water will not boil so quickly.

EMERGENCY RADIATOR REPAIR.

Several practical methods have been suggested from time to time in these columns for the temporary repair of a damaged radiator, but one of unusual nature is given by a local repairman. He was called to the country to repair a car on which the radiator had been badly damaged. A number of raw potatoes were cut into suitable portions and wedged into the openings, which were so well sealed that the machine was run to the garage on its own power. This suggestion may be helpful for stopping small leaks; the potato will remain in position regardless of the temperature of the water.

LIGHTING SUGGESTION.

Nearly every motorist has experienced trouble at one time or another in lighting

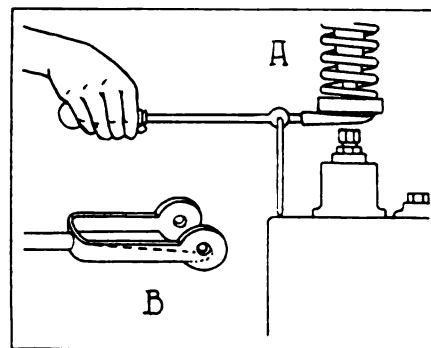


Fig. 165.—A Simple Valve Tool Made of a Discarded Part.

oil lamps when the wind is blowing. Usually the match is extinguished before the wick becomes ignited. A suggestion which may prove helpful under such conditions is to turn the wick up for about a half-inch before applying the match. This allows the kerosene to work up through that portion which has been compressed. Turn it down to its ordinary height and when the match is applied it will light readily as there will be sufficient oil in the charred end of the wick.

PAINTING EXHAUST PIPE.

An excellent preparation for painting the exhaust manifold of the automobile can be made by mixing turpentine and flake graphite. Saturate a piece of waste with the mixture and then rub it over the metal while it is hot. A beautiful polish will be imparted to the pipe.

POLISH FOR VARNISH.

A polish which will renovate varnish work can be made of one quart of good vinegar, two ounces butter of antimony, two ounces of alcohol and one quart of oil. Shake well before using.

CASE HARDENING.

A well known metal expert advises kerosene may be used to harden steel. Smear the article thoroughly with ordinary washing soap and then beat it to a cherry red in a charcoal fire. Next plunge it into a kerosene bath. While there is no danger of the kerosene igniting from the heated metal, it is advisable not to have any naked flame near by. Parts hardened by this process are said to be free from cracks and do not warp.

CELLULOID CEMENT.

To repair celluloid articles, use three parts of alcohol and four parts of ether. Thoroughly mix and apply to the fracture with a brush until the edges become warm, after which they are pressed together and allowed to dry for at least 24 hours.

NANTUCKET BANS AUTOMOBILES.

Residents Protest Against Raising the Ban--New York Society Attacks Automobile Bureau--Other Legal Matters.

Nantucket Island, off the coast of Massachusetts, has the only community remaining in the United States to whose streets and roads automobiles are not admitted. Recently there was a hearing before the Massachusetts legislature to lift the ban, but the residents of the island turned out almost en masse to protest against the change. Many said that if automobiles were allowed to come they would move away and would not return. Among these was Mrs. William Barnes, wife of the New York politician, who said she had spent every summer for the last 28 years on the island.

It was said that 90 per cent. of the summer residents and a majority of the permanent residents were against admitting cars. So there is no likelihood that the ban will be lifted. The party favoring it, represented by two men, said the admission of motor cars would raise the value of the land 100 per cent. in 10 years, and the Nantucket Cranberry Company, which desires to use trucks, declared that when it went into business there it was assured that trucks would be permitted at all times except three months in the summer.

S. F. F. A. PROTESTS.

The Safety First Federation of America criticises the New York state automobile bureau, which, it says, was placed in the secretary of state's office instead of under the highway commission for purposes of patronage. It is pointed out that the cost of the registration clerical force in New York amounts to 15 per cent. of the amount of money collected, while in Ohio the same work is done for nine per cent., in Massachusetts for eight per cent. and in Pennsylvania for six per cent.

The federation is anxious to have a traffic commission appointed in New York to codify traffic regulations for the state and see that they are enforced. The board would serve without salary, but for some reason, according to Darwin P. Kingsley, president of the federation, Governor Whitman is against such a commission.

SPECIAL HEADLIGHT JUDGE.

To abolish the uncertainty regarding the suitability of their headlight arrangements under the regulation promulgated by the Massachusetts Highway Commission, motorists are demanding that a special judge or commissioner be appointed to try all headlight cases.

When the commission issued its regulation it defined certain conditions which a headlight must meet. The light must show any substantial object in the road for a distance of 150 feet, and 10 feet to the side and 10 feet ahead of the car,

and the rays of light must not be more than $3\frac{1}{2}$ feet from the ground 50 feet from the car.

No means of accomplishing this result was specified, but the owner was left to judge for himself whether his lights met the conditions. Since then three men, who had tried to meet the conditions, have been arrested and two of them have been held for trial.

The demand for a special headlight judge is made on the theory that he would acquaint himself thoroughly with the conditions and would insist on a uniformity of headlight arrangement, whereas if the regular judges handle the cases each is likely to have a different standard and the motorist can never know just what to expect.

OPPOSE COLORADO LAW.

Much opposition has been aroused among Colorado dealers over the provision in the licensing law which makes the size of the fee relative solely to the horsepower rating advertised by the manufacturers. This ruling is costing hundreds of owners from \$2.50 to \$5 more than they would pay if the Society of Automobile Engineers' formula were in use.

Owners are complaining of the fact that manufacturers advertise cars of, for instance, 38.4 horsepower by the engineers' formula as 48 horsepower and thereby make necessary the payment of a \$10 instead of a \$5 fee. The dealers denounce the law and are preparing to make a fight on it in the next legislature.

BANS GLARING HEADLIGHTS.

An ordinance forbidding the use of muffler cut outs within the city limits and regulating glaring headlights has been introduced in the city council of Portland, Me., after conferences with the state highway commission and the Maine Automobile Association. This will be thoroughly tried out in the city and at the next session of the legislature the automobile association will undertake to have a state law of similar portent passed.

WANT VEHICLE COMMISSION.

Two bills providing for the establishment of a motor vehicle commission to take over the duties of the Massachusetts Highway Commission with regard to motor vehicles have been introduced into the Massachusetts legislature. This would leave the highway commission free to devote all its time to road business and leave the matter of the registration of cars and licensing of drivers to the new commission.

The bills are favored by the National Automobile Association and the National Highway Association, as well as the Highway Safety League. The present highway commission believes that there is no need for the separation and holds that the present commission is giving more attention to the licensing of automobiles than is given generally in other states.

WANT PUBLIC TAXI STANDS.

A hearing was given by the Massachusetts legislature recently on a bill to establish public taxi stands at certain points to be designated by the police commissioner. At present cabs are not allowed to stand near private property without the consent of the owner and this leads to a system of rentals from hotels.

Those who argued for the bill said that it would provide better service and cheaper fares since the cabs could wait for passengers at either end of many runs and would not have to return empty. The chauffeurs' union protested against the bill on the ground that in New York City it had brought so many individually owned cabs into the business that some of the union members employed by the large companies had lost their positions.

LOOSE LEAF LICENSE LISTS.

Mimeographed loose leaf license lists of the cars registered in Connecticut have been issued by the secretary of state. They are to be kept in the hands of the police constantly. They afford a complete list of automobile owners. Formerly the police had to depend on books and in the case of a recently licensed car not included in them, about which information was desired at night or after the secretary of state's office closed, it was necessary to wait until the next morning to look it up.

MAKERS ARE RESPONSIBLE.

An article published in the Fordham Law Review by Judge Cuthbert W. Pound of the New York court of appeals, takes the position that if an automobile sold by a manufacturer which has concealed defects that result in injuries, the maker is liable for damages. He bases the contention on a decision in a case concerning the sale of a land roller which had a defective tongue in which a knot had been concealed by putty and paint. The tongue broke and injured the purchaser.

DEMAND BRIGHT REAR LIGHTS.

New York City police have been examining motor cars and trucks to determine whether their rear lights are such that the numbers can be distinguished at a distance of 50 feet. On the first day 1581 persons were warned and it was announced that thereafter summons would be served. Out of 31,560 vehicles examined in garages, 27,398 were found to have lights that were unsatisfactory to the police.

FASHIONABLE MOTORING HATS MADE OF FABRIKOID.

When a woman starts on a motoring trip one of her chief worries concerns the condition of her clothes, particularly her hat, after a ride over dusty roads or, perhaps, through a sudden shower.

This worry can now be greatly minimized, for a recent development is a material called fabrikoid, which outvalues glazed kid, is impervious to rain or dust, and can be used to make a hat as chic as a Parisian creation. Furthermore, it is right in line with Dame Fashion's edict calling for leather in feminine millinery.

Fabrikoid has the waterproof qualities of rubber and can be washed with soap and water without the slightest injury to its texture or finish. It is pliable and can be used to cover a frame and also to furnish the trimmings on any style of hat. As for colors, the material is made in a bewildering variety, from solids to the most delicate of shades.

Fabrikoid hats are certain to be seen in abundance upon the highways of the country this season. The shops are carrying ample stocks, so that the motor

one in wood brown and sunset bronze tipped off with a Hiawatha quill. Of course these color combinations can be made to suit taste of the motor maid, as can the shapes of the hats. The same latitude in personal taste is offered in using fabrikoid as there is with cloth or other material.

Fabrikoid is produced by the Du Pont Fabrikoid Company, Wilmington, Del., and it has found favor in the automobile world because of its great durability and wide range of applicability, as well as its low cost of production.

Amateur milliners can make very stylish models with Du Pont fabrikoid at a cost of not more than \$1, and even less, depending on the value of the frame used. It requires only about three-fourths of a yard to cover a normal size frame and one-quarter of a yard for trimming. The material is on sale at large department stores, or it can be obtained by sending 50 cents to the Du Pont Fabrikoid Company, Wilmington, Del. When

eliminate the waste of raw material. Furthermore, the initial expenses of getting out a new model had been paid during the first year, including the cost of the special tools.

DOUBLES FOUR PRODUCTION.

The Jackson Automobile Company, Jackson, Mich., which is making both four and eight-cylinder cars this year, has doubled its production schedule for its four-cylinder model 34. When the season began it was predicted that it would be impossible to dispose of fours in large quantities and that eights would be in the greatest demand. The Jackson company has discovered a large number of buyers who are not much interested in multiplicity of cylinders and who would rather have a four-cylinder engine.

REWARD FOR AUTO THIEVES.

The Automobile Club of Hartford, Conn., through a recent meeting of its



Striking Examples of Three Stylish Designs Which Can Be Made of Fabrikoid, They Being Low in Cost and Impervious to Dust and Rain.

maid can make up her own creation if she desires. Three styles that are bound to win favor are shown in the accompanying illustration.

Some of the most popular combinations are the Directorie hat, made of hunting green and trimmed with a white cockade of the same material, the high crown (almost like a man's silk hat) and narrow brim making a striking headpiece.

A little poke bonnet that will appeal to many women is in black and white, strapped on with machine stitching and completed with two white cammellias over each ear. This is a dainty and distinctive design.

For those who favor turbans there is

ordering direct, the color should be specified.

REGARDING PRICE REDUCTION.

Replying to the numerous claims that the only way to reduce the price of motor cars under present conditions is to cheapen the car, the Cole Motor Car Company declares that \$200 was clipped from the price of its eight-cylinder model this year and still the car was improved.

This was done by eliminating lost motion in the manufacturing processes; removing frills and furbelows that add nothing to the quality or individuality of the car while increasing its cost; by using greater care in manufacture to

board of governors, voted to offer a standing reward of \$50 for information leading to the arrest or conviction of any person who drives away a car belonging to a member of the club, unless the person has permission.

NEW PILGRIM CAR COMING.

The Pilgrim car, a four-cylinder model, to sell at \$735, has been built after designs by R. C. Aland, and plans have already been formulated for a production of 4000 this year. The factory will be located in Highland park, outside of Detroit. C. H. Leete is president of the company.

The Time Payment Plans for the Selling of Motor Pleasure Cars.

Five Large Car Makers Have Already Announced That Their Cars Can Be Bought on Time.

One of the latest developments in the selling of motor vehicles, and one that vitally interests every owner and distributor, is the sale of cars on the basis of deferred or installment payments. Five large car makers—Chalmers, Maxwell, Overland, Paige and Studebaker—have already made public announcements that, under certain conditions, their product may be bought on a time basis.

This plan is one of the most important that has yet been introduced to the motor vehicle industry, and is one that is certain to speed up sales and greatly expand the market. Other lines of industry have been conducted along similar lines and with much success, and there seems to be no logical reason why the sale of motor cars cannot be done along the same lines.

It is noteworthy that in the case of every announcement made so far there is a reputable and long established banking concern behind the plan. Behind the Overland is the Guaranty Securities Company, Toledo. Chalmers cars are backed by the Agricultural Credit Company, Chicago; Studebaker by the Commercial Investment Trust, St. Louis and New York City; Maxwell by the American Commercial Corporation, New York City; Paige by the Bankers' Commercial Corporation, New York City.

The manufacturer is not financially associated in any of the plans so far made public. His sole connection is that he has made the arrangements between the credit houses and the dealer. There is little difference in the general features of the five plans mentioned, the chief dis-

tinguishing points being in some small details.

Generally speaking the dealer is required to collect half or a third of the list price of the car, and the cost of fire, theft and transportation insurance as the initial payment, as well as six per cent. on the notes for the balance which the buyer signs. The balance must be paid in eight monthly installments.

The next step in the plan is to have the dealer indorse the purchaser's notes before sending them to the banking concern, which buys at face value, less a brokerage charge that ranges from two to three per cent. in the majority of cases. Some of the plans arrange that the bank will send the dealer the full amount of cash immediately, while others provide that from \$100 to \$200 be held back and the dealer be given a deferred certificate for the amount so withheld. This is intended to keep the dealer interested in the transaction up to the moment the buyer has made his last payment, which is expected to make him more concerned in seeing that the payments are made on time.

In the case of the deferred certificate, the dealer can cash it after the final installment has been paid into the bank, or he can use it immediately upon issuance by sending it to the car manufacturer as part payment for a new lot of cars. The maker will accept it at value less a discount of five per cent.

The dealer is instructed as to the procedure in investigating the desirability of extending credit. He is furnished with all the necessary forms and note blanks in order that each transaction may be made in uniform manner and in accordance with the system laid down by the banker.

Some of the plans are so arranged as not to interfere with whatever local banking arrangements a dealer may have. In fact, the latter may transact the deferred payment deal through his town bank if he desires.

S. A. E. Announces Completion of Plans for This Summer's Cruise.

Trip Will Be by Steamer Noronic, Which Has Accommodations for 550, and Will Last Four Days.

The summer cruise of the Society of Automobile Engineers on the steamer Noronic is to be more extensive this year than last. It will include a visit to Mackinac island, as well as the usual run through Georgian bay.

The boat, which has accommodations for 550 men, will leave Detroit, Monday, June 12, at 2 p. m., and arrive at Mackinac at 11 the next morning. Leaving at 6 o'clock it will arrive at Killarney, Ont., at 7 a. m. the next morning and the day will be given over to a picnic. It will leave Killarney at 5 the next morning and arrive at Owen sound at 3 p. m., leaving for Detroit at 7 in the evening and arriving in Detroit at 7 the next evening.

Last year most of the accommodations available on the boat were taken. This year the interest is so much greater that all of them are expected to be reserved by May 1. Only one evening, Monday, will be occupied by a professional session, and the remaining evenings on the boat will be given over to entertainments, including dancing.

In order to give all members of the party an opportunity to become acquainted there will be a promenade on the deck Monday afternoon and another on Friday just before the boat reaches Detroit. Arrangements have been made so that those wishing to charter motor boats and go fishing on picnic day can do so by stating their requirements to the committee in charge.

AIDS STOLEN CAR LOSERS.

To aid owners of Overland cars whose machines are stolen, the Willys-Overland Company has arranged a system whereby the description is turned in to the local dealer and sent by him to the factory. It is there printed in a bulletin, which is distributed to Overland dealers all over the country and displayed by them on the walls of their garages. Sooner or later the car will be taken to an Overland garage and will then be discovered and returned to its owner. Very often the thieves are captured by the same means.

KING ADOPTS ALUMINUM.

The King Motor Car Company, Detroit, in spite of the acute shortage of aluminum, has adopted the aluminum alloy piston for its new eight-cylinder car. The company has had a quantity of the material in stock for some time and has refused fancy prices for it. It is now generally conceded among engineers that the pistons of that metal are to be widely used in the future.



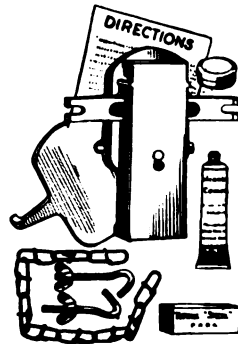
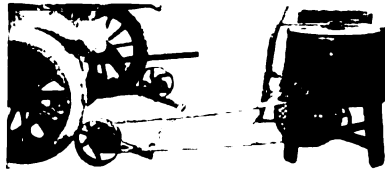
Overland Dealers from Michigan, Ohio and Indiana Waiting at the Willys-Overland Plant at Toledo to Get Cars as They Come Out of the Works, Not Being Able to Obtain Enough as Quickly as They Need to Meet the Extraordinary Winter Demand Being Felt in All Parts of the Country—132 Cars Were Thus Delivered in One Day—The Shortage of Suitable Freight Cars Has Been so Acute That the Overland Company Has Been Shipping in Gondolas and Flat Cars.

MOTOR CAR ACCESSORIES AND EQUIPMENT.

"HELPING HENRY."

"Helping Henry" is the trade name applied to the device shown in the accompanying illustration and the purpose of which is to obtain belt power from a car. By its use the motor is made to serve the purpose of a stationary or portable gas engine. It is especially useful in emergencies when there is a break down of the power plant. This attachment will accomplish approximately the same work as any gas engine; tests have determined that within 20 per cent. of the horsepower of the engine will be delivered. Attachment to the car is simple, it being effected in a few minutes without the use of bolts, screws or tools. The car can be run indefinitely and without injury to furnish power.

Manufactured by the Auto Power Company, 914 F. Michigan avenue, Chicago, Ill. List price, \$20. Purchaser may have a 30 days' trial of this equipment.



SURE-CURE VULCANIZER.

The Sure-Cure automatic steam vulcanizer is designed to fit tubes and casings of any size. It is a metal body which is partly filled with water at the factory and never requiring refilling. Gasoline is used as a fuel to turn water into steam. The steam thoroughly cures the raw rubber without danger of burning it. Statement is made that due to the simplicity of operation an inexperienced person can do perfect vulcanizing on the first trial.

This vulcanizer is especially useful for tourists, as it will burn evenly in the strongest wind. It is nicely nickel plated and packed in a neat box fitted with a slide cover. All necessary supplies and instructions are furnished.

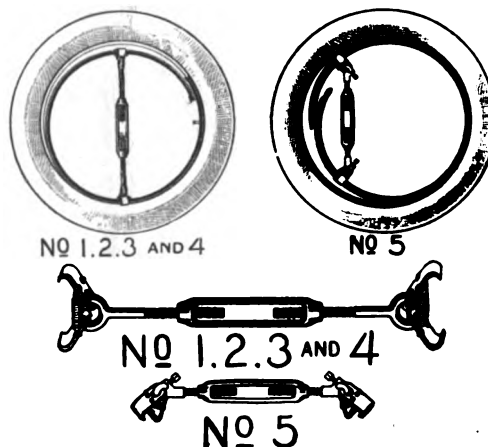
Manufactured by the National Motor Supply Company, Cleveland, O. List price, \$2.25.

KIMBALL AUTO JACK.

The Kimball auto jack is designed to operate wherever there is room to set a jack. It is especially convenient for use under those cars which have a great rear overhang. A long handle provides for easy placement, raising and lowering without the operator having to crawl under the car. The jack is of the screw type with a diamond pointed hardened steel top, which is said not to slip on any surface. The screw raises the car rapidly.

Ball bearings carry the lift and thrust, thereby reducing friction. The handle is composed of three separate pieces which when assembled together afford a handle of great length. It turns on a ball joint, which permits its use in any position and contributes greatly to the ease of operation.

Manufactured by the F. W. Mann Company, Milford, Mass. Kimball auto jacks



are made in three sizes and five styles and range in price from \$3 to \$6. Write for complete details and free trial offer.

TIGHT-WAD PISTON RING.

The Tight-Wad piston ring for Ford cars is claimed by the maker to save gasoline and oil, to insure high compression and to be absolutely leak proof. The disadvantages of losses caused by leaky piston rings, such as gas getting past the piston into the crank case, loss of power from poor compression, lack of lubrication, oil passing into the explosion chamber, etc., are familiar subjects to the car owner. The maker states that Tight-Wad piston rings will eliminate all these troubles.

Only one ring to a cylinder is required. It is said that they will wear indefinitely and will keep the valves and spark plugs clean and also increase the power of the motor.

Manufactured by J. Horat, Lafayette, Ind. Price \$1.25 each, or \$5 per set of four.

RIM CONTRACTOR-EXPANDER.

The manufacturer states that the Best rim contractor-expander, illustrated here-with is a "common-sense" rim tool, which will operate quickly on all types of split, demountable rims. This is accomplished by a turnbuckle which affords equal power for expanding or for contracting a rim.

Two types are manufactured. The ones designated by the numbers 1, 2, 3 and 4 are designed to operate across the centre of the rim, and the No. 5, which is a shorter tool, across the chord. The first mentioned will fit all rims from the smallest to the largest. No. 5 is fitted with a set screw at each end to take up the slack in the clamps. This design permits it to fit every rim.

The function of these tools is to remove and replace all demountable rims quickly and easily and protect the shoe and tube from cuts and tears during the operation.

Manufactured by the Fish-Best Company, Grand Rapids, Mich. List price of Nos. 1, 2 and 3, \$2 each; Nos. 4 and 5, \$2.50 each. The maker will supply a descriptive circular upon request.

EQUIPMENT FOR FORD CARS.

Any Ford car may be converted into an extremely attractive machine by the use of Universal specialties. In the accompanying illustration is shown the Universal streamline tourabout body, which is built of heavy gauge steel and strongly reinforced. Deep upholstery, spring cushions, ample leg room and wide seats combine to insure comfort. The upholstering material is guaranteed fabric, manufactured by the Boston Artificial Leather Company. The equipment of the body includes a robe rail, foot rail, scuff plates,

floor carpet, lock plates and knobs. The finish, which passes through 15 painting operations, is said to be the equal of any popular make of car. Black with gold stripe is the standard color, although the body can be finished in any special color at the additional charge of \$10. The one-man top and rain vision ventilating windshield shown in the illustration are made especially for this body and will not fit the regular Ford car.

The Universal streamline raceabout body for Ford cars, also illustrated herewith, is built of the same steel construction as the one previously described. Spring cushions and deep well-stuffed upholstery insure easy riding. The standard color of this body is red with black trimmings. The hood and fenders are finished in black and the radiator may be obtained in black or nickel.

Spranger demountable rim wire wheels are also standard equipment. These afford lightness combined with strength and insure a substantial saving on tires and increased gasoline mileage. The wheels attach to the axle shafts in the same manner as the original wooden ones. They may be obtained in red, green, black or yellow. When a special color is desired an extra charge of \$5 is made.

The streamline radiator and hood have much to do with converting the appearance of the Ford car. The V shape radiator affords a greater cooling surface and a greater volume of water. The hood is made of heavy gauge steel, well enamelled and finished. As there is a special hood for models previous to 1915, this fact should be specified when ordering. A special starting crank, hood clamp brackets, bolts, etc., are supplied with the equipment.

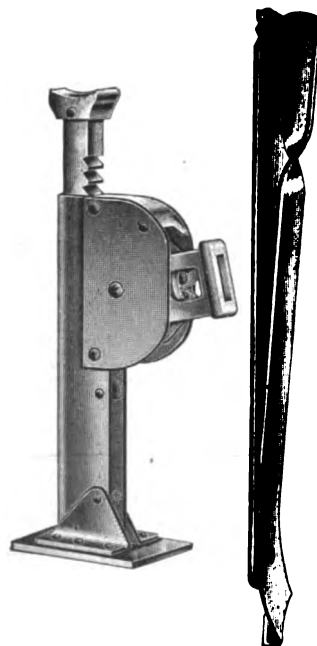
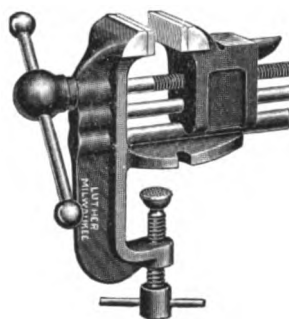
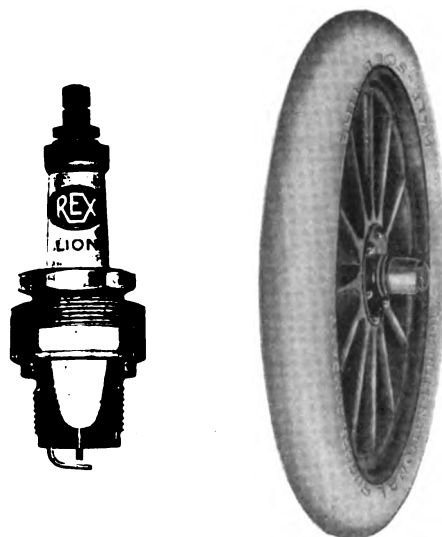
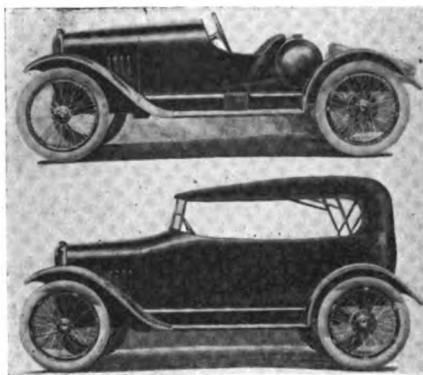
Marketed by the Universal Car Equipment Company, 251 E. Jefferson avenue, Detroit, Mich. List price of tourabout body \$150; mohair or khaki top and windshield \$38 extra. Raceabout body, with 15-gallon tank and tire supports, \$100. Crown fenders, shown in illustrations, listed at \$14; radiator and hood, \$45; wire wheels, \$35. Five demountable rims are furnished.

"REX LION" PLUGS.

The manufacturer gives an unlimited guarantee to each purchaser of the "Rex Lion" spark plug illustrated herewith. The insulating cores used in its construction are declared to be of the finest imported material and are absolutely warranted to hold the insulating qualities regardless of conditions in gasoline combustion engines.

The electrodes are of imported meteor wire which is impervious to the effects of heat. Each plug is packed, assembled and tested by hand. A gas-tight joint is guaranteed. Fouling and sooting are said to be impossible because of the large chamber. This plug is made to fit all standard makes of cars.

Manufactured by the Rex Ignition Manufacturing Company, Broadway and 58th street, New York City. Prices supplied on request.



INTERNATIONAL TIRES.

The International rubber half-sole tire shown in the accompanying illustration is built exactly like the conventional high-grade tire with the exception of the bead. There are three to six piles of tire fabric solidly vulcanized together, a thick cushion of elastic rubber which protects the fabric from breaks and ruptures, and an outside tread which is made up $\frac{1}{2}$ inch or more of especially compounded tough live rubber.

The half-sole tire is an outer casing that is designed to fit over the worn tire and greatly increase the mileage. These casings can be obtained to fit any kind of a tire. They are guaranteed against puncture and the price is about half the cost of the ordinary equipment.

Manufactured by the International Rubber Company, Denver, Col. Complete details supplied on request.

LUTHER CLAMP VISES.

A good vise is a useful tool for every person who handles tools and one of the best is the Luther clamp type shown herewith. It is declared that due to its design, it is impossible to wear or spring the jaws out of alignment. This is insured by the movable jaw being above the steel guides, which in turn are supported by the bench. The vise is made exceptionally durable by the use of steel guides, steel screws, steel jaws and handle.

Manufactured by the Luther Grinder Manufacturing Company, 285-289 South Water Street, Milwaukee, Wis.

NEW LANE JACK.

The outstanding feature of the new Lane jack illustrated herewith is that the operator does not have to crawl under the car to place, operate, reverse or take it out. It is equipped with a 30-inch handle that is jointed so that it may be conveniently carried in the tool box. It is operated by very short strokes, the direction of which is controlled by the distance the handle is entered into the socket. If the handle is pushed in for the full distance the jack raises; lowering is accomplished by pulling the handle back about a half inch.

There are two automatic spring notches on the handle which engage the part of the socket that corresponds to these two positions. These notches serve to hold the jack securely onto the handle.

Manufactured by the Lane Brothers Company, Poughkeepsie, N. Y. Further description and price on request.

BLUE RIBBON SPECIALTIES.

The quality of Blue Ribbon products is assured by the fact that this line is priced, described and specialized in more than 95 per cent. of American jobbers' catalogues. They are widely advertised and in the near future will be seen conspicuously exhibited in most dealers' windows, as the maker is planning a national window display contest.

The Blue Ribbon cream metal polish is adapted for use on any metal, especially brass, copper and nickel, and but little physical effort is required to produce a mirror-like brilliancy. Frequent polishing is unnecessary because of the lasting quality of the lustre.

Two new products, which are deserving of special mention, are the Blue Ribbon black gloss enamel for retouching and refinishing worn or damaged metal parts, and the Blue Ribbon auto top, seat and lining dressing for refinishing and waterproofing leather, mohair, pantasote and their substitutes. Other products included in the line are a nickel polish, body gloss, radiator cement, cold cream hand soap and an oil soap for washing the machine.

Manufactured by the International Metal Polish Company, Indianapolis, Ind. Complete descriptions and prices sent on request.

ANTI-PINCH INNER TUBE.

The Anti-Pinch inner tube is made of alternate plies of white and gray rubber, with an extra red rim reinforcement, which doubles the thickness of the tube at the point where most tube troubles occur. The red strip is so vulcanized that it arches inward and away from the rim while the tube is being inserted into the casing. This is said to do away with the chief causes of tube pinches. The illustration reproduced herewith shows how the rim reinforcement is vulcanized to arch inward.

The universal size for Ford cars are full 30x3 1/2-inch tubes so made that they can be used in the 30x3-inch front tires.

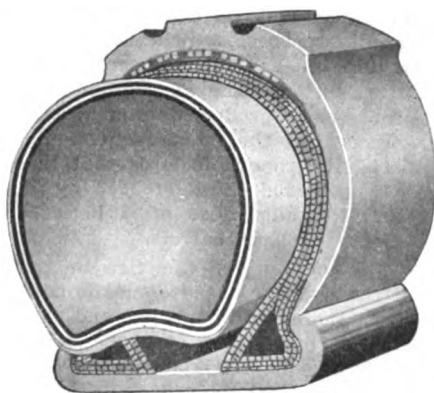
Marketed by the Double Fabric Tire Company, Auburn, Ind. Prices will be supplied by the manufacturer.

THE TELOMETER.

The telometer shown in the accompanying illustration is designed for testing the various cylinders of an internal combustion engine to determine the height of compression in pounds per square inch. It also enables the operator to calculate the actual horsepower developed by each. The device screws into the spark plug opening and the exact compression under running conditions is recorded on a small card, which is furnished.

By the use of this instrument the operator or the repair man can quickly locate any lost efficiency without disas-

The prices given in connection with these descriptions of accessories and equipment are the latest retail quotations by the manufacturers or distributors, and they are subject to change without notice. When addressing the manufacturer or distributor always mention The Automobile Journal to insure immediate attention.



INFLATING VALVE.

Those garage men who have been annoyed by the carelessness of patrons, who after inflating their tires, neglect to shut off the flow of air, should investigate the Schrader automatic inflating valve, which is shown herewith. Its use insures against waste of air before, during and after inflation.

This device can be supplied with different sizes of shanks, from 1/4 to 5/8-inch, to fit any garage air line. When properly installed, air can only be obtained by applying the nozzle of the inflating valve against the tire valve. This opens the check in the angle valve and allows the passage of air into the tire. The instant that the pressure on the tire valve is removed, the valve in the hose automatically closes.

Manufactured by A. Schrader's Son, Inc., 800 Atlantic avenue, Brooklyn, N. Y. List price, \$1.

SHOCK ANNIHILATORS.

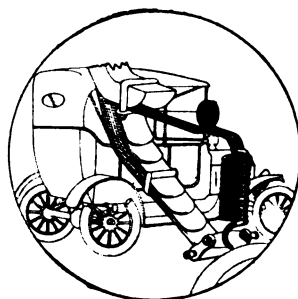
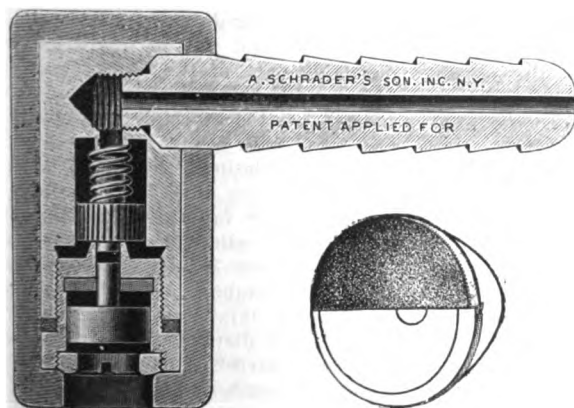
Burrows shock annihilators are designed to prevent all shocks and eliminate all side swaying of the Ford car. They are constructed of the finest spring steel. The top bar is made of 1x3/16-inch flat steel. It has formed in it a two-inch coil which affords extreme flexibility. Attachment is made to the chassis bar. The expansion spiral spring hooks to the hub bracket by a special hook.

Manufactured by the Burrows-Overton Company, 1328 Broadway, New York City. List price, \$3.50 per set.

MONARCH LAMP DIMMER.

The Monarch adjustable automobile lamp dimmer, illustrated herewith, can be attached either to the lower or upper part of the headlight to eliminate glare. It is attached by a coil spring and when set will not move. The dimmer is made in five sizes: Eight, nine, 10, 12 and 13-inch diameters.

Manufactured by the Monarch Carriage Goods Company, 2838-44 Spring Grove avenue, Cincinnati, O. Prices and particulars on request.



The Government's Survey of the Gasoline Situation.

Secretary of the Interior Department
Compiles Startling Figures
for Congress.

THERE has been so much agitation and so many conflicting statements regarding the gasoline situation in the United States that a Senate resolution asking a number of questions of the secretary of the interior to produce information was recently passed.

The reply showed a tremendous increase in gasoline production as was, of course, expected. The following table gives the figures:

	Gasoline Produced.	
	Barrels	Barrels
1899.....	6,680,000	1909.....12,900,000
1904.....	6,920,000	1914.....34,915,000
1915.....		41,600,000

With regard to the amount consumed the department could give no accurate figures, only the amounts produced in various years, the amounts exported and the difference between the two, which is presumably the amount consumed in the United States, although much of it may have been held in storage. The figures follow:

Year	Production	Exported	Difference
1899...	6,680,000	297,000	6,383,000
1904...	6,920,000	594,000	6,326,000
1909...	12,900,000	1,640,000	11,260,000
1914...	34,915,000	5,000,000	29,915,000
1915...	41,600,000	6,500,000	35,100,000

That the fields from which crude oil is now drawn are approaching exhaustion is shown by the following table:

Field	Present Gasoline factor (per cent.)	Production including 1915 (millions of barrels)	Estimated percentage of exhaustion
Appalachian	25	1150	74
Lima-Indiana	12	438	93
Illinois	18	251	60
Mid-Continent	18	617	50
North Texas	20	44	41
Northwest Louisiana	20	58	47
Gulf Coast	3	236	79
Colorado	20	11	79
Wyoming	20	12	5
California	2 1/2	835	34

Estimates of the amount of crude petroleum in the various fields which still remains to be pumped from the wells are given as follows:

Field	Estimated percentage of exhaustion of total oil content	Petroleum remaining in fields (millions of barrels)
Appalachian	70	481
Lima-Indiana	93	31
Illinois	51	244
Mid-Continent	25	1874
North Texas	8	484
Northwest Louisiana	22	124
Gulf	13	1500
Colorado	65	6
Wyoming and Montana	2	540
California	26	2345
Total.....		7629

In addition to these areas Alaska, Arizona, Utah, New Mexico, Michigan, Arkansas, Alabama, Nebraska, Missouri, Washington and Mississippi contain areas of potential oil production and may add 75,000,000 barrels. There are possibilities also of finding oil in Oregon, North Dakota, South Dakota and the coastal regions of the middle and south Atlantic states.

It is possible, according to the report, to increase the supply of motor fuel by blending the lighter with the heavier distillates. Carburetors can be improved to utilize directly such heavy distillates as kerosene. The Burton cracking process can be used to secure a larger amount of motor fuel from the crude oil. The same is true of the Rittman cracking process, which was brought out in 1915, but has not yet been put in operation. There are also other cracking processes to produce the same effect.

Regarding the mooted question of exports, the report declares that those of 1914 exceeded those of 1913 by 500,000 barrels, while those of 1915 exceeded 1914 by 1,500,000 barrels.

The causes for the rise in gasoline prices are: Increased domestic consumption, increased imports, and the decreased production of crude oil in the Cushing pool in Oklahoma. While the stocks of Cushing crude at the end of 1915 were 15,000,000 barrels greater than at the beginning of the year, they reached their maximum in July and have been steadily diminishing. The stocks are in the hands of the larger companies who got them at low prices, but in view of the falling off of production the smaller refiners are forced to pay a high current price or even to buy at a premium. Thus the high prices are the result of a shortage that is looming in the future rather than one that already exists, so far as the big producers are concerned.

The relation of the price of crude oil to that of gasoline is shown in the following table:

	Gasoline prices per gallon	Crude oil prices per barrel
1915		
Jan. 1.....	\$1.13	\$1.46
Feb. 1.....	.12	1.50
March 1.....	.12	1.50
April 1.....	.12	1.40
May 1.....	.12	1.35
June 1.....	.12	1.35
July 1.....	.12	1.35
Aug. 1.....	.12	1.60
Sept. 1.....	.14	1.70
Oct. 1.....	.16	1.80
Nov. 1.....	.17	2.00
Dec. 1.....	.19	2.00
1916		
Jan. 1.....	.21	2.25

It is also pointed out that the recent rapid advances in the price of crude oil and of gasoline have been accompanied by equally rapid advances in the price of stocks of most of the stronger oil companies, indicating that the business at the higher prices is more profitable or that the companies have profited greatly by the rise in the price of the stock which they already owned.

The conclusion of the report is that the big companies are making very large profits through the superior financial strength and foresight, which enabled

them to take advantage of the rising market for crude oil, while the smaller companies are operating on a very narrow margin.

Possibilities of improvement of the situation are to be found in the use of benzol, which is produced as a by-product of the making of coke by most of the large coke producers. There are great areas of oil shales in Colorado and Utah that may yield crude oil from which gasoline can be made, but their development waits a sufficiently high price of gasoline to make the operations profitable.

ENDURANCE OF MOTOR DESIGNS.

An analysis of those records of the Automobile Chamber of Commerce that show the number of years various cars and motors have been offered to the public has been made by the Winton Company.

Of the 65 makers who are now members of the chamber, only 15 belonged in 1908. These are Winton, Locomobile, Pierce, Haynes, Franklin, Apperson, Oldsmobile, Packard, Studebaker, Cadillac, Buick, Lozier, Stearns, Chalmers (Thomas-Detroit) and Peerless.

In the nine years from 1908, these 15 makers placed on the market a total of 110 models, ranging from a 10-horsepower single-cylinder to a 66-horsepower six-cylinder. Eighty-five of the 110 models have been abandoned, leaving 25 on the market today. And of 25 current offerings nine are on the market this year for the first time, so that only 16 are offering motors which have had a year's trial.

The size and type of motor which has shown the greatest longevity is the 48-horse. The first was the Winton of 1907. This car is still made and is in its ninth year. Pierce-Arrow produced a similar car in 1909 and still continues it and the Locomobile model of the same size was produced six years ago.

One maker in the nine years has produced 11 models and is this year offering two entirely new ones. Another maker discarded nine models and is producing a new one. Winton in the nine years produced three models and is now making two of the three. Another maker retains two of five.

OIL DRILLERS ACTIVE.

The high price of crude oil has resulted in great activity among oil drillers and during January 1916 wells were completed and put in operation in the oil fields east of the Rocky mountains. These wells bring in a new production of 174,285 barrels of crude per month. As compared with December there were 271 fewer completions, but an increase in new production of 81,277 barrels.

The largest falling off in the completion of new wells was in Kansas and Oklahoma, where 315 less were completed than in December. New production was greatest in Oklahoma, where large wells in scattered districts swelled the output to 78,697 barrels, an increase over the previous month of 30,268 barrels.

SUGGESTIONS FOR THE FORD CAR OWNER.

Determining the Condition of the Clutch Components for Wear and the Means for Restoring Efficiency—Dismantling the Drum Assembly of the Transmission.

The 44th article dealing with the operation, construction, maintenance, care and repair of the model T Ford chassis is the fifth of the series devoted to adjustment, restoration and overhauling.

When the clutch disc drum has been exposed by the removal of the clutch discs the condition of the discs should be ascertained by examining them carefully in a strong light. The discs will wear proportionate to the use of the car and, of course, the character of the lubrication has material bearing on them. When the discs are installed at the factory they are uniform in thickness and are perfectly smooth. The discs are a good quality steel and are heat treated or tempered to endure wear, for in the driving of the car they are a part of the time in frictional contact, but despite the best of lubrication they will be more or less worn.

Some forms of disc clutches have facings of anti-friction material riveted to them, which has precisely the same influence as the lining of a break or the facing of a cone clutch, that is, the facing prevents slipping, but the Ford clutch discs revolve partly in the lubricating oil, which insures against friction and prevents harsh engagement, and they should be sufficiently lubricated so there will be no serious wear, even with thousands of miles of driving.

How the Clutch is Assembled.

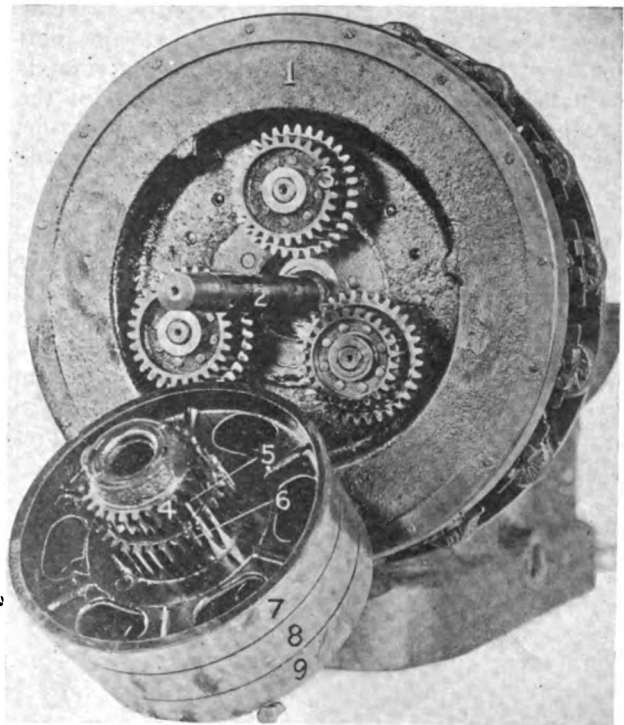
There are 26 of these discs, 13 of which fit the notches on the clutch disc drum and 13 fit the ribs or splines of the brake drum. When the pressure of the clutch spring is exerted against the discs they are firmly in contact so that the entire assembly will turn as a unit, but when the clutch spring pressure is released by compressing the spring with the clutch pedal the discs will separate and the brake drum will remain stationary and the clutch disc drum will turn with its discs between the series of discs secured to the brake drum. The distance ring or master disc will turn with the clutch disc drum, at all times. The driving plate will always turn with the brake drum.

Many drivers slip the clutch, that is, they will partly release the pressure of the spring, which will allow the discs driven by the clutch disc drum to revolve between the other series of discs, and this causes wear of the discs and the distance ring. The best of lubrication will simply minimize this wear, and eventually the discs and the distance ring will be reduced in thickness. This wear can be compensated in part by adjusting the screws in the clutch fingers that bear upon the

studs of the driving plate, but this adjustment can be made only a half turn of the screws at a time.

Means of Adjustment Limited.

When the adjusting screws in the fingers have been turned forward as far as is possible restoration of the efficiency of the clutch can be made by inserting two additional discs, one of each type, and the adjusting screws can be turned back from the studs of the driving plate until there is sufficient clearance. The reason for the half turn movement only of the adjusting screws against the studs is that the screws are locked or



Transmission Assembly Removed from Transmission Shaft.

- | | |
|-----------------------|-------------------|
| 1—Flywheel | 6—Slow Speed Gear |
| 2—Transmission Shaft. | 7—Reverse Drum |
| 3—Triple Gear | 8—Low Speed Drum |
| 4—Driven Gear | 9—Brake Drum |
| 5—Reverse Gear | |

secured by cotter pins that pass transversely through the clutch fingers and the screws. The screws are drilled but once, and this necessitates a half turn forward whenever adjustment is made.

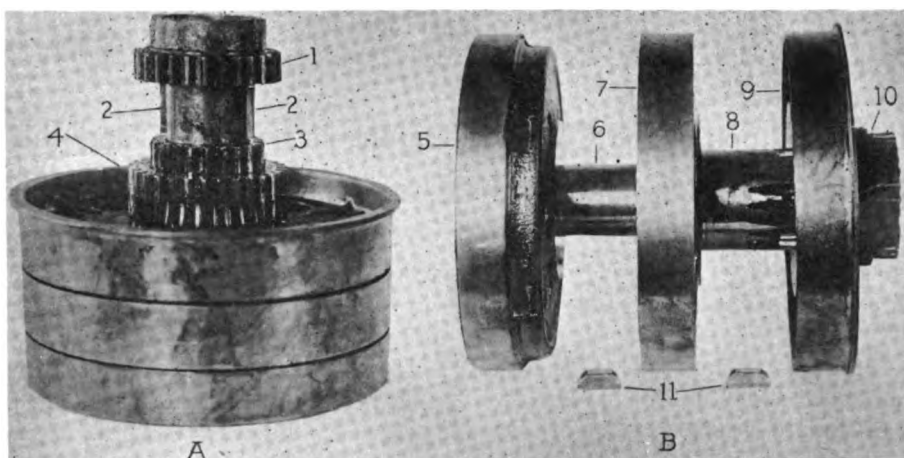
Much finer graduation is possible and practical, for by drilling the screws once at right angles to the bore already existing in them quarter turn adjustment could be made, and by drilling two

additional holes in each screw the movement could be made the sixth of a turn. No provision that is not considered absolutely essential is ever made in the construction of Ford chassis, for manufacturing cost has been computed with extreme care for every work and every part, no matter how trifling, and for this reason only what is actually necessary is done. The drilling of the second hole in the adjusting screw is desirable, but reasonably close adjustment can be made with only one, so no further provision is made.

Plates Formed To Separate Easily.

The clutch discs are formed so that there is a slight spring movement when they are compressed and this has a tendency to separate them when the pressure of the clutch spring is released, and when the discs are lubricated they will slip easily. Extremely little clearance is necessary to release the clutch when it is well adjusted, and this clearance is naturally increased with wear.

Ordinarily all the discs will wear somewhat with use and seemingly this will be equal upon all of them. But the wear is not always equal as may be determined by examination. Not



Disassembling the Transmission Drums and Sleeves: A, the Driven Gear Clear of the Keys that Retain It to the Sleeve of the Brake Drum, Showing Both Keys; B, the Brake Drum, Slow Speed Drum and Reverse Drum Separated to Show the Relative Sizes of the Sleeves, and the Manner of Telescopic Assembly—One Will Note the Wide Faces Surrounding the Sleeves of the Brake and Slow Speed Drums to Insure Bearing Surfaces.

- 1—Driven Gear
- 2—Driven Gear Keys
- 3—Slow Speed Gear
- 4—Reverse Gear

- 5—Brake Drum
- 6—Brake Drum Sleeve
- 7—Slow Speed Drum
- 8—Slow Speed Drum Sleeve

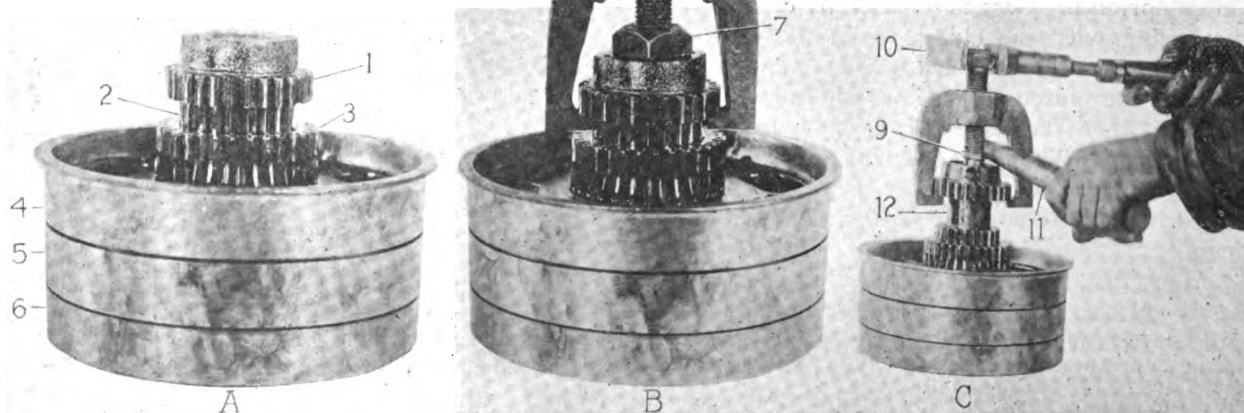
- 9—Reverse Drum
- 10—Reverse Drum Sleeve
- 11—Driven Gear Keys

only this, the distance plate or master ring, being hardened, which is pressed against the flange of the brake drum will wear into the flange, which is a casting and is softer metal. No lubrication will prevent this, especially, if

the clutch is slipped fully when in use. Sometimes the discs will be found to be scored and roughened. If they are bright and smooth the thickness is not so important, for the adjustment will insure good contact, but if they are cut and rough the clutching will be harsh and will cause "grabbing," which is certain to impose severe stresses upon the power transmission system and is decidedly unpleasant for the occupants of the car.

Determining Condition of the Discs.

Roughening of the disc surfaces and scoring may be due to the metal not being perfectly tempered or heat treated, the discs being too soft, or the rings may have heated because of insufficient lubrication and the temper so reduced that they will be cut more or less. By examination of the rings the condition can be readily judged. If they are bright and smooth, no matter if worn,

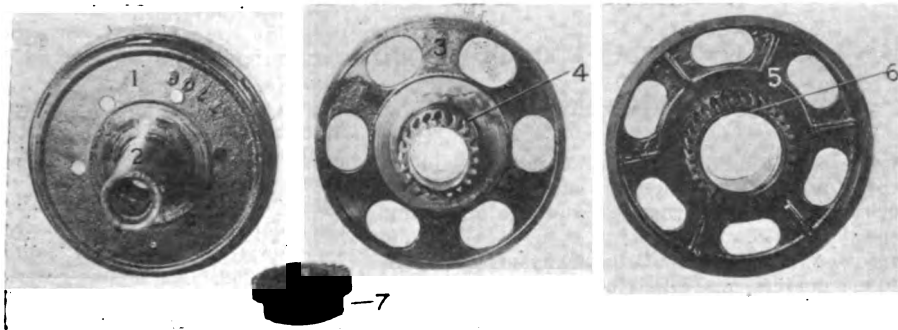


Removing the Driven Gear from the Brake Drum Sleeve; A, the Assembly of Drums, Sleeves and Gears on the Bench; B, Transmission Puller Adjusted for Pulling Gear; C, Turning Puller With a Wrench and Holding It With a Short Lever Bar, a One-Man Job.

- 1—Driven Gear
- 2—Reverse Gear
- 3—Slow Speed Gear
- 4—Reverse Drum

- 5—Slow Speed Drum
- 6—Brake Drum
- 7—Nut on End of Brake Drum Sleeve
- 8—Transmission Puller

- 9—Plunger on Brake Drum Sleeve
- 10—Monkey Wrench
- 11—Short Lever Bar
- 12—Driven Gear Key



Forward Sides of the Transmission Drums and Sleeves.

- 1—Brake Drum
2—Brake Drum Sleeve
3—Slow Speed Drum
4—Slow Speed Sleeve and Gear

- 5—Reverse Drum
6—Reverse Drum Sleeve and Gear
7—Driven Gear

they will serve satisfactorily, but if they are blued and colored from heating they should be rejected and replaced with new, because the color indicates that the temper has been reduced and the discs will become scored or roughened and will cause the clutch to "grab" and stick, possibly after a very short period of use. The thickness of the discs is not important, provided that they are smooth and retain their temper, but the thickness of the distance plate governs to a considerable degree the efficiency of the clutch.

As this plate sets against the flange that carries the brake drum, and the plate is hardened and the flange is cast metal, the flange will eventually wear, no matter how much care has been taken with reference to lubrication. So long as the plate is carried on the clutch disc drum the clutch will be efficient, but if it is so reduced in thickness, or the flange is so worn that the plate will slip between the drum and the flange, two possibilities for restoration are open. The one is a new distance plate, which may be thick enough to be carried on the disc drum, and the other is to replace the brake drum and sleeve.

Wear of the Brake Drum Flange.

The wear of the brake drum flange may be determined readily enough, for there may be a circular groove or channel cut into it where the distance plate seats against it. If such a channel exists instead of a perfectly even surface the depth must be the determining factor. If more than $1/32$ of an inch deep the probabilities are that the distance ring will slip between the disc drum and the flange, in which event a new brake drum and sleeve are necessary.

There are those who maintain that the clutch discs can be restored if they are cut or

rough by smoothing them with a fine file and finishing with emery cloth, but if the roughness is caused by heating and the reduction of temper such plates had best be taken out and replaced by new, as the clutch is too important in the operation of the machine to take chances of future trouble.

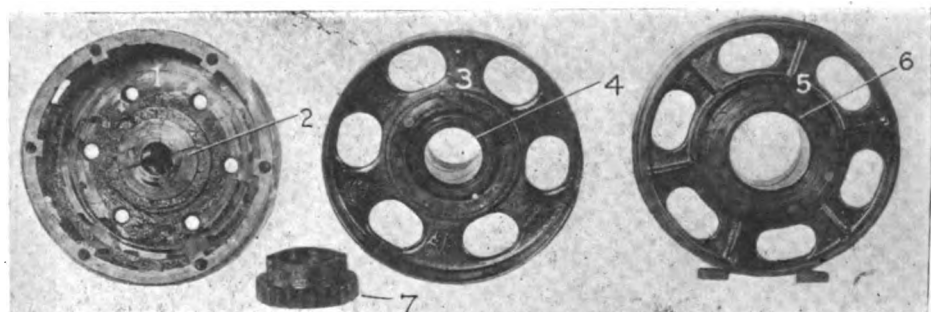
There is another fact to

be considered, and that is that the engine block must be removed from the chassis to disassemble the transmission gearset, and removal and disassembling entails considerable labor and expense. For this reason when the clutch is disassembled it should be given very careful attention to insure that it will be in the best possible condition and that it will be serviceable without further work for as long a period as is practical.

Removing the Drum Assembly.

When the clutch disc drum has been removed from the transmission shaft the drum assembly can be taken from the transmission shaft, by simply drawing it back. When removed the unit will be as seen in the first illustration, the sleeves of the reverse drum and the slow speed drum telescoping over the brake drum sleeve in the order stated and as the ends of the sleeves of the reverse drum and the slow speed drum are cut to form spur gears, when these are assembled they form what is a two-faced spur gear, but the sleeves may be turned on or within each other. One will note from the accompanying illustrations, however, that there is a third spur gear, and this is the driven gear, which is fitted to the end of the sleeve of the brake drum and is secured by a pair of keys. With this gear keyed the three drums and gears are as a unit.

(To Be Continued.)



Rear Sides of the Transmission Drums and Sleeves.

- 1—Brake Drum
2—Brake Drum Sleeve Bushing
3—Slow Speed Drum
4—Slow Speed Drum Sleeve Bushing

- 5—Reverse Drum
6—Reverse Drum Sleeve Bushing
7—Driven Gear

INDUSTRIAL NOTES AND COMMENT.

Splitdorf Building \$200,000 Addition—Hyatt Expanding at Detroit and Newark—Inter-State Drive-Away.

Addition for Splitdorf—A \$200,000 fire-proof reinforced concrete building, 300 by 60 feet and containing more than 30,000 square feet of window space, is to be erected for the Splitdorf Electrical Company of Newark, N. J., and will be ready for occupancy about July 1. It will contain about 2½ acres of floor space and will greatly increase facilities for the manufacture of Splitdorf magnetos and electrical starting systems. There will be 198 windows, each measuring 17 by 9½ feet. Adjoining the main structure will be a 65 by 20-foot L, completely equipped with wash rooms, toilet facilities and locker rooms for the employees. The outside of the addition will be relieved by use of colored tile and embossed work. The Splitdorf company is very busy, and is now furnishing electrical equipment for more than 35,000 automobiles a month and employs 2400 workers, not including the 400 at the Sumter works and the 300 in branch stores.

National Motor Band—Shop employees of the National Motor Vehicle Company have formed a band consisting of 46 members, who recently made their initial appearance in public at the Indianapolis automobile show. There are three other such organizations in the National factory: a bowling team which now leads the Indianapolis city league; a baseball team, "runner-up" in the 1915 city league contest; the National employees' benefit association, which is officered exclusively by shop employees and is now in its second year.

Overland Shipments Doubled—During the first two months of this year, shipments of Overlands and Willys-Knight cars totalled 27,685, as against 10,240 for the corresponding period of 1915. The Overland model 75 figured largely in these totals, though the others maintained their respective standings. The Willys-Overland plant has been expanded

by the addition of new buildings, and its present facilities are now three times greater than they were at the beginning of 1915.

Inter-State Drive-Away—Over 175 dealers and distributors from Indiana and Ohio engaged in a "drive-away" from the Inter-State Motor Company's plant at Muncie, Ind., recently and took away 150 cars, valued at more than \$100,000. The idea is credited to George Kanouse, Indiana Inter-State distributor, and the event was said to be the biggest ever attempted in that state. The visitors were lavishly entertained at banquets and trade meetings, and were addressed by B. W. Twyman, general manager of the Inter-State company; W. C. Ball, George M. Kanouse and Eugene Vatet.

Hyatt Expanding Rapidly—With one six-story building just completed and two eight-story structures under way, A. P. Sloan, general manager of the Hyatt Roller Bearing Company, announces that still another, which will be 12 stories high, will be erected in Newark, N. J. This last will be 75 by 200 feet and of the same general reinforced concrete and brick construction, as the newest units at the Detroit factory. The lower floors will be used for manufacturing operations, the upper floors for offices. Hyatt activities at Newark have been paralleled at Detroit, where a beautiful new office building just completed is being occupied by the general offices and the engineering force of the automobile department. A two-story warehouse has also been erected and it handles an average daily shipment of 25,000 bearings from the Newark factories.

Dort Expands Its Plant—Additional space for the Dort Motor Car Company, Flint, Mich., has been obtained by the purchase of the building known as warehouse A of the Durant-Dort Carriage

Company, which contains approximately 100,000 feet of floor space. This addition will make possible a production of from 60 to 70 cars a day. Six months ago Dort production was around 10 cars a day.

Studebaker's Preparedness—The Studebaker Corporation reports that its additions, costing more than \$1,000,000, which were begun last October, are now nearly complete. When in full operation, the company will be able to produce cars at the rate of 400 a day, instead of the present 300. Among the equipment improvements is the installation of seven forging machines for producing gear blanks; two 500 horsepower water tube boilers and a 2000 horsepower low pressure turbine generator.

Sparks Withington Increasing—Following the decision of the stockholders of the Sparks Withington Company, Jackson, Mich., to increase the capitalization to \$1,000,000, arrangements were made to double the space occupied by the plant in order to increase the volume of output. The new building will be completed about July 1 and 300 men will be added to the payroll, making a total of approximately 800.

Courtesy First at Chalmers—To eliminate the loss of time by salesmen and other visitors at the Chalmers Motor Company offices, who heretofore, as in other plants, have been compelled to wait a wearisome time to see the man they called upon, Vice President Pfeffer has inaugurated a card system by which the name of the caller and the man he is waiting for is recorded, when the visitor has been delayed more than 10 minutes. The plan has already served the purpose of eliminating much waste time, and is highly commended.

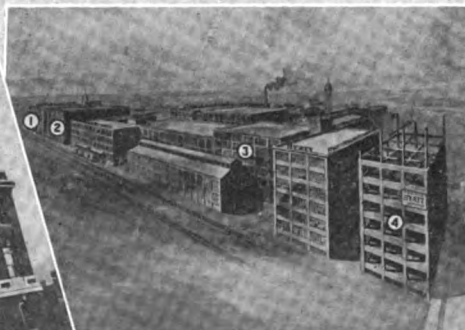
Pathfinder Airship Motor—It has been rumored that the Pathfinder Company, Indianapolis, manufacturer of the Pathfinder Twin-Six, is developing a motor for aviation purposes. The report is neither denied nor confirmed by the company's officials.

Detroit Adds to Plant—Increased production of the Detroit Six has compelled the Detroit Motor Car Company, Detroit, to add 10,000 more feet of floor space to the general painting department

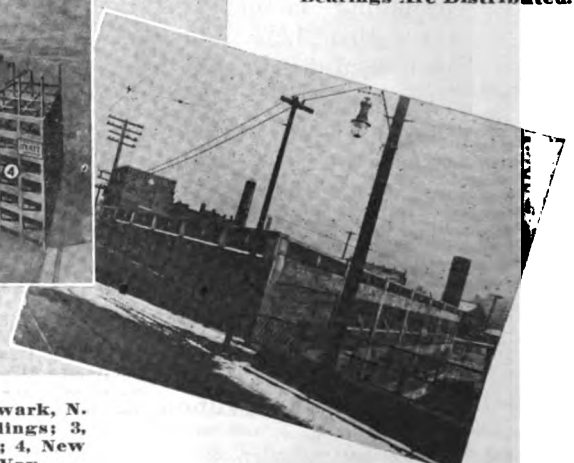
New Hyatt Office Building at Detroit, Which Also Houses Engineering Department.



New Hyatt Warehouse at Detroit, Where Hyatt Bearings Are Distributed.



Hyatt Roller Bearing Plant at Newark, N. J.—1 and 2, Eight Story Buildings; 3, New Heat Treating Department; 4, New 12-Story Structure Now Under Way.



of the main manufacturing plant.

Chalmers Starts Addition—Having just finished one large addition, the Chalmers Motor Company, Detroit, has broken ground for another, which will be 400 by 60 feet, four stories high and cost \$150,000. The building will have a 50 by 60 foot wing, and will be an exact duplicate of the other large units of the Chalmers plant, which is now working upon a basis of 40,000 production. Factory offices and storerooms will occupy the main floor, while the remaining floors will be utilized for manufacturing.

Puritan Buys Again—The Puritan Machine Company, Detroit, announces the purchase of the Scripps-Booth Cycle Car parts business, which includes jigs, dies, tools, blue prints and drawings. This acquisition makes almost 100 "orphan companies" taken over by this unique Michigan concern, including some of the largest as well as the smallest companies. Having the parts and means of making more of so many cars that are not now being manufactured, the Puritan company is in a position to render a real service to owners of those machines.

Paige Factory Swamped—Though it has been increasing its manufacturing facilities and its production as rapidly as possible, the Paige-Detroit Motor Car Company announces that it faces a shortage of Fairfields, the Six-46 seven-passenger model, although the plant is working day and night. On March 1 the number of orders on the factory books from Paige dealers totaled 3748 cars, having an approximate value of \$4,000,000, which shows a tremendous increase over orders on hand on the corresponding day last year.

PANAMA CLUB FORMED.

The Panama Automobile Club is the latest addition to the American Automobile Association. It has a membership of 600 and is composed of officers, physicians and officials of the United States in the Canal Zone, as well as citizens of Panama. There are only 26 miles of road there and less than that in the Republic of Panama. Furthermore, the speed of cars is restricted to eight miles an hour and registration fees are \$30 a year. An effort is being made to have the regulations in force in the District of Columbia applied to the Canal Zone.

Nearly every phase of country life has been quickened and stimulated by the motor car. It has made it easy for farmers to go considerable distances for entertainment in the evenings, with the result that the number of gatherings to discuss subjects of interest to them has increased enormously and organizations that were formerly impossible are being formed all over the country. It has developed good roads and thereby has had much to do with the establishment in various parts of the country of large schools of the city type which draw children from a large surrounding district.

Now comes Rev. Dr. F. F. Bahner, a minister of Waynesboro, Penn., who testifies that the attendance at his country churches has been greatly stimulated by the arrival of motor cars.

VANDERBILT CUP AT SANTA MONICA.

Racing Classic Is Scheduled for Latter Part of April in Famous Southern California Winter Resort.

The Vanderbilt Cup race will be held this year at Santa Monica, Cal., in the latter part of April. That track was given the honor because though it had been scheduled for that city in 1915 the event was transferred to the San Francisco Exposition.

Both the Sheepshead bay speedway and the Indianapolis speedway officials had applied for the race for this year, but their request was refused because W. K. Vanderbilt, the donor of the cup, objected to the contest being run on a track.

It is said that the Santa Monica course is too much like a speedway to please the donor, who would prefer a more difficult course. There are only two bad curves in it. Application has been made to have the race in 1917 at Fresno, Cal., in connection with the annual raisin day celebration in April.

SAXON INCREASES ITS PRICE.

The list of prominent makers who have recently increased their prices as a result of the materials situation contains such names as Studebaker and Buick and has just been increased by the addition of the Saxon Motor Company, Detroit, which has raised the price of its six-cylinder model in both roadster and touring types to \$815.

A. C. PLUGS ON 33 MAKES

A census of the cars shown at the recent Boston show indicated a very marked verdict in favor of AC spark plug equipment, which are made by the Champion Ignition Company, Flint, Mich. These plugs were equipment on 33 makes of cars on display at the show as compared to 14 makes for the nearest competitor.

The list of cars which use AC plugs includes Packard, Cadillac, Marmon, Hudson, Chalmers, Hupmobile, Haynes, Chevrolet, Dort, Cole, National, Buick, Oakland, Oldsmobile, Dodge, Reo, Paige, Chandler, Daniels, Peerless, Stutz, Saxon, Velie, Jackson, Apperson, Stearns-Knight, Scripps-Booth, McFarlan, Empire, Simplex, Detrolter, Monroe and Westcott.

Up to a few days ago plugs were selected on the basis of good insulation which would not crack too easily when heated and points that would not soot too easily. But with the modern high speed engine and the higher compression, knocking, back-firing and missing were finally traced to the plugs and it then became the rule to insist also that spark plugs be gas tight and that they remain gas tight.

NEW BARRETT EXPANSION JOINT.

A new material put up in ribbon form for use as an expansion joint in concrete, brick or block pavements has been prepared by the Barrett Company. It is a mastic that comes ready to lay in ribbon form and in a variety of widths and thicknesses. It contains no felt or paper reinforcement.

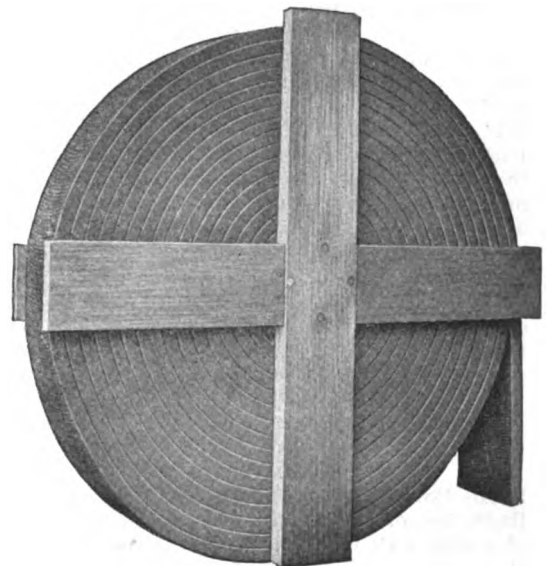
A new process called "Fibre Weld" gives it enough cohesiveness to stand handling in the ribbon form without reducing the elasticity that is necessary for expansion requirements. It is water and weather proof and is not injured by street acids or automobile oils. It does not become brittle with age or cold and does not soften and run in hot weather.

Its chief advantage over poured bituminous joints is that it makes heating and pouring apparatus unnecessary and reduces the labor very materially.

ROADS IN ENGLISH HISTORY.

Comparing the condition of the roads in some parts of the United States with those of England two centuries ago, the American Highway Association quotes from Macauley, who described conditions under which the coaches travelled over the muddy highways and were frequently forced, especially in the winter, to have oxen pull them out of the bogs.

Even then there were extreme conservatives who fought road improvement because of its tendency to disturb settled conditions. When the flying coach with frequent relays of horses and able to go 50 miles per day was introduced there was a great uproar from vested interests who petitioned the King to have the use of such coaches prohibited.



Barrett's New Fibre-Weld-Process Expansion Joint for Use in Concrete, Brick and Block Pavements.

SENATE CUTS GOOD ROADS MONEY.

Materially Reduces Provisions of Shackleford Proposal—Road Workers Are Becoming Very Active.

For the Shackleford good roads bill, which passed the house, providing for a distribution of \$25,000,000 a year among the states for the construction and maintenance of good roads, the Senate committee has substituted another measure providing for the distribution of \$5,000,000 this year, \$10,000,000 in 1917, \$15,000,000 in 1918, \$20,000,000 in 1919 and \$25,000,000 in 1920.

The bill provides for the factor of area as well as for population and mileage of post roads in the distribution; it requires that a state must have a highway department to get the money, and places maintenance on the states with the provision that further apportionments for construction may be stopped if the roads already built are not properly kept up.

ARCHES ON LINCOLN HIGHWAY.

The Lincoln Highway Association has joined with the American Institute of Architects in the matter of a suitable design for arches to be erected on the state lines crossed by the Lincoln highway. The first of these is to be erected on the Wyoming-Utah state line, at the personal expense of B. F. Redman, a Lincoln highway enthusiast. The best professional advice on the matter will be available through the architects' organization.

The Salt Lake Yellow Stone Trail Association is to be organized at Pocatello, Idaho, expressly for the purpose of rushing the construction of a road 350 miles long from Salt Lake City to Yellowstone park to enable tourists to pass over the Lincoln highway to make that side trip if they desire. It will touch the following towns in Utah and Idaho: Ogden, Brigham, Malad, Tremontaine, Pocatello, Idaho Falls, St. Anthony and Ashton.

CONVICT WORK IN WYOMING.

Governor Kendrick of Wyoming is a warm advocate of convict work on the roads, which was tried in his state in 1914 for the first time. The crews built roads in six counties and did it so well that all the counties applied for more prisoners the next year. The work was done as well as it is done by free labor.

Both the governor and his wife are very much interested in prison reform and with the Yellowstone Highway Association is planning a large amount of convict work for the roads of the state during the present year.

URGE HIGHWAY CONSERVATION.

The recent Sixth American Good Roads Conference in Pittsburg urged the limitation of the weight of motor vehicles with a view to conserving the roads. It advocated laws drafted for this purpose. Good roads work was urged as a measure of preparedness and the value of the excellent roads of Germany and

France in the present war was pointed out.

The conference favored the use of serial instead of sinking fund bonds to raise money for good roads purposes and passed a resolution expressing its pleasure at the rapid progress that is being made throughout the country in good roads work. A session was devoted to the comparative value of brick and concrete roads, and the delegates inspected various types of patent roads that have recently been perfected and placed on the market.

EXTEND PIKES PEAK HIGHWAY.

Extensions of the Pikes Peak Ocean-to-Ocean highway so that a definite route will be marked and improved from the Atlantic to the Pacific were discussed at the annual meeting of the association, which was held at St. Joseph, Mo.

The committee on western extension was authorized to study all of the available routes west of Rifle, Col., and to decide on a definite routing for the road through Utah, Nevada and California.

IMPROVED ROADS IN UNITED STATES.

	Miles of Public Roads	Miles of Surfaced Roads	Pct. Sur- faced
Alabama	49,639	5,491	11.1
Arizona	5,987	400	6.7
Arkansas	36,445	1,085	3.0
California	48,069	9,388	19.5
Colorado	30,571	655	2.1
Connecticut	12,582	3,300	26.2
Delaware	3,000	241	8.0
Florida	17,954	2,625	14.6
Georgia	83,986	12,500	14.9
Idaho	18,406	611	3.3
Illinois	94,141	9,000	9.6
Indiana	63,370	26,831	42.3
Iowa	104,027	2,505	2.4
Kansas	111,536	1,170	1.0
Kentucky	58,000	10,636	18.3
Louisiana	24,962	697	2.8
Maine	25,628	3,264	12.8
Maryland	17,025	2,706	15.9
Massachusetts	17,272	8,928	51.7
Michigan	68,906	8,859	12.8
Minnesota	91,890	6,206	6.8
Mississippi	44,072	1,800	4.1
Missouri	120,000	8,000	6.6
Montana	23,319	100	0.4
Nebraska	80,338	250	0.3
Nevada	12,751	65	0.5
New Hampshire	15,116	1,025	6.8
New Jersey	14,842	4,500	30.3
New Mexico	16,920	900	5.3
New York	80,112	22,398	27.9
North Carolina	49,802	6,166	12.4
North Dakota	61,592	200	0.3
Ohio	83,681	28,312	33.8
Oklahoma	71,325	500	0.7
Oregon	42,930	3,994	9.3
Pennsylvania	87,387	3,976	4.5
Rhode Island	2,121	1,246	58.8
South Carolina	45,549	4,888	17.3
South Dakota	56,354	290	0.5
Tennessee	45,913	5,564	12.1
Texas	128,971	9,790	7.6
Utah	7,970	1,653	20.7
Vermont	15,082	3,278	22.7
Virginia	43,399	4,482	10.3
Washington	37,000	4,250	11.5
West Virginia	31,629	825	2.6
Wisconsin	61,080	11,500	18.8
Wyoming	10,569	450	4.3
Total	2,273,131	247,490	10.9

Following negotiations the committee on eastern extension has had under way for some months, a meeting was held in Indianapolis two weeks later and a definite route for the road from Indianapolis eastward was selected and a movement was launched to organize state associations in the various states.

The eastern route from Indianapolis will go through Richmond, Ind., Dayton, Springfield, Columbus, Pittsburg, Johnstown, Altoona, Huntington, Harrisburg, Reading and Philadelphia. There is a branch from Harrisburg to Washington and from Reading to New York City.

It is planned to mark this route as a national highway.

1,000,000 BICYCLES.

The bicycle trade is booming for almost the first time since the motor car came upon the market, and manufacturers are looking forward to sales of 1,000,000 during 1916, the same figure, curiously, that has been predicted for the motor car production.

The revival of interest in the bicycle is shown by the fact that at Palm Beach and the California winter resorts the sport has again been taken up with almost the same popularity which it had formerly with the well-to-do.

There has been a great increase in club activity and the associations in the various cities report constantly growing memberships. There was more bicycle racing in 1915 than for many years.

In addition to these facts the movement for road improvement is having the same effect on the bicycle that it has on the motor car and sections of the country are being opened up for the comfortable use of the two-wheel vehicle where that was not possible before.

Most manufacturers believe that the bicycle did not deserve the sudden eclipse that overcame it with development of the motor car. They blame much of that on the fact that hundreds of dealers lost interest in the business and took to selling motor cars, so that it lost the advantage of an effective sales force. The price of a good bicycle nowadays ranges from \$30 to \$50 and some can be had for less.

TO BEAUTIFY LINCOLN HIGHWAY.

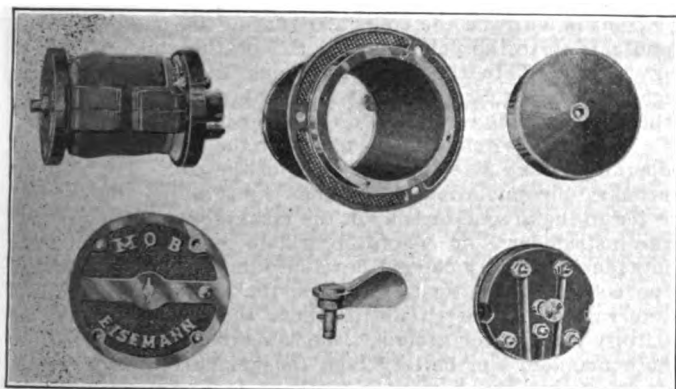
From Oakland, Cal., as far East as Salt Lake City, the Lincoln highway is to be marked with signs giving the distance to the California city. Already a large portion of the money is in hand and more will be raised at the motor power show which is to be held in the city's new \$1,000,000 municipal auditorium, April 24, when 20 per cent. of the receipts will be turned into a fund for highway improvement.

The Oakland Chamber of Commerce and the Rotary Club are planning to cooperate in planting trees along the route through Alameda county. Beds of geraniums three feet wide will also be planted. The geranium is an ever blooming flower in that part of California and the effect will be beautiful.

PRACTICAL FACTS FOR NEW CAR OWNERS.

Elementary Instructions in the Economical Operation, Maintenance and Repair of the Ignition System---the Eisemann E M Magneto---Answers to Inquiries.

The Eisemann E M dual ignition system consists of a direct high-tension magneto and a combined coil and switch. The coil is only used when operating on the battery, so as to



Members of the Eisemann High Tension Dual Ignition Coil, Type D. C., 1911 Model.

increase the voltage of the battery current, while the switch is used in common by both battery and magneto systems. The Eisemann type E M magneto, which is of the armature type, is practically the same as a single-ignition, high-tension instrument. In these two ignitions the vulnerable parts of each are distinctly separate from those of the other. For instance, a separate contact breaker is used for each ignition, so as to prevent the crippling of both systems by an accident. Parts that are not subject to accident or wear are used in common so as to avoid unnecessary duplication.

Generation of Current.

The field or region permeated by lines of magnetic force is formed by steel magnets, which are bent in the shape of a horseshoe. The lines of magnetic force flowing from the magnets are carried by two pieces of soft iron, which are termed the pole pieces. A shuttle armature mounted on annular ball bearings rotates in the magnetic field.

The armature is a core made of many pieces of soft sheet iron riveted and screwed together. Wound around this is a primary winding of medium gauge copper wire, over which is a secondary winding consisting of many coils of a very fine wire, which is specially insulated in the entire length, and the layers carefully insulated from each other. The low-tension current formed by rotating the armature induces a secondary or high-tension current in the fine coils. This transformation is accomplished by suddenly interrupting the low-tension current by a mechanical contrivance termed the contact breaker or make-and-break mechanism.

The attention of the reader is called to the fact that in the high-tension magneto the armature practically incorporates a transformer coil, which is wound directly around the armature core and has a circuit breaker to interrupt the primary current.

The Pole Pieces of the Magneto.

Of special interest is the shape of the pole pieces used in the type E M Eisemann magneto. The most extended portion is approximately in the plane of the theoretical axis of the core of the armature wound upon the anchor. The flow of the magnetic lines of force is drawn from the extremities of the poles toward the centre of the core. The entire volume of the magnetic lines of force is thus forced through the armature and cannot diffuse.

By referring to the illustration of the pole pieces, it will be noticed that the construction is such that at no time is the armature entirely isolated from them. This arrangement prevents demagnetization and sudden breaking of the magnetic field. Noiseless operation is thus insured and wear on

the driving coupling or gear is reduced to a minimum.

The Make and Break Mechanism.

The make-and-break mechanism is so termed because it alternately joins the two ends of the primary current and then suddenly separates them. This mechanism is a very important member of the instrument and it is imperative that it opens and closes in a fixed relation to the position of the armature. It consists of a bronze plate, on the back of which, and cast in one piece with it, is a cone fitting into the armature shaft, which is bored out and provided with a key way.

When the armature has reached the correct position, the breaker points are separated, which breaks the primary circuit and induces a current in the secondary winding. The secondary winding is grounded at one end and when connected to the spark plug at the other end delivers a spark in the cylinder.

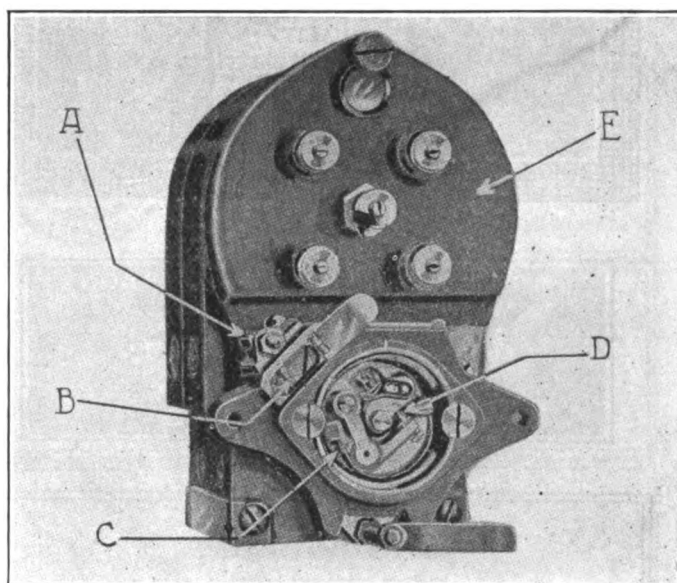
In addition to this the magneto is also fitted with a battery circuit breaker, mounted at the back of the magneto breaker. It consists of a steel cam having two projections which actuate a steel lever mounted in the breaker housing. This breaker has the advantage of being very accessible and permits easy adjustment of the platinum contacts.

Easy Control of the Spark.

Since the secondary current is produced when the primary circuit is broken by the separating of the platinum contacts, it is obvious that the instrument can be so timed as to produce a spark sooner or later by having these contacts open earlier or later. This variance of timing is accomplished by the angular movement of the timing lever body which affords a timing range of approximately 30 degrees. The spark is fully retarded when the lever is moved to the extreme limit in the direction of the armature rotation. The advance is, of course, obtained by pushing the lever in the opposite direction.

The Eisemann Safety Spark Gap.

When the spark plug cables are fractured or disconnected from the plugs, or the electrode distance of the plug is too great, the high tension current is apt to cause damage either to the insulation of the armature or of the coil in its attempt to find a circuit. In the Eisemann magneto this is impossible

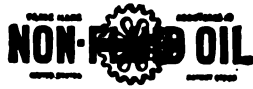


Showing Breaker Cover Removed from Type E M Eisemann Magneto---(A), Adjustable Battery Contact Breaker Screw; (B), Platinum Battery Breaker Points; (C), Magneto Make and Break Lever; (D), Platinum Magneto Breaker Points; (E), Distributor.

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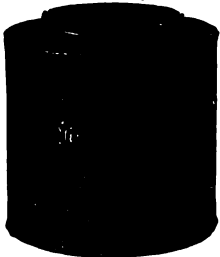
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as the high tension current would discharge itself at the safety gap, which is fixed on the armature case cover.

Storage Batteries Recommended.

The manufacturer recommends the use of a storage battery with the dual ignition. The coils are designed to operate on six volts and if a dry battery is to be used it should consist of 10 cells connected in multiple series. Two sets of five each must be formed, the cells being connected carbon to zinc. The two groups are then connected by joining the two zincs and the two carbons which are free at the end of each group. The two wires, one from the zinc end and the other from the carbon end, are the two terminals of the battery.

The Eisemann Wiring Diagram.

The wiring diagram for the Eisemann E M dual system is shown in the accompanying illustration. The high tension current is led from the collecting ring of the magneto at HM and carried to the point marked HM on the coil. From here it is carried to the switch, H, and then returned to the magneto at H. From here it is distributed by a segment to the different plug terminals in the order of firing.

When the switch handle is placed on the battery side several operations take place in the switch of the coil. The magneto primary current, which flows from the terminal marked MA, is led to the ground or body of the magneto, and this prevents the instrument from generating a high tension current. The low tension battery current flows into the coil at (+), through the coil to R and thence to R on the magneto. Here it is interrupted by the circuit breaker; then it returns to the battery through the ground. The same distributor is used for both magneto and battery high tension current. When the switch is on the battery side there is a connection made between the end of the coil's secondary winding and the terminal H on the coil, thus sending the battery current over the same route as that of the magneto.

Simplicity of Maintenance.

The only lubrication required by this instrument is the injecting of a few drops of oil into the reservoirs about every 1000 miles. All wiring connections must be kept tight and correct, and the cables must not be allowed to wear out. At the first sign of breaking they should be replaced.

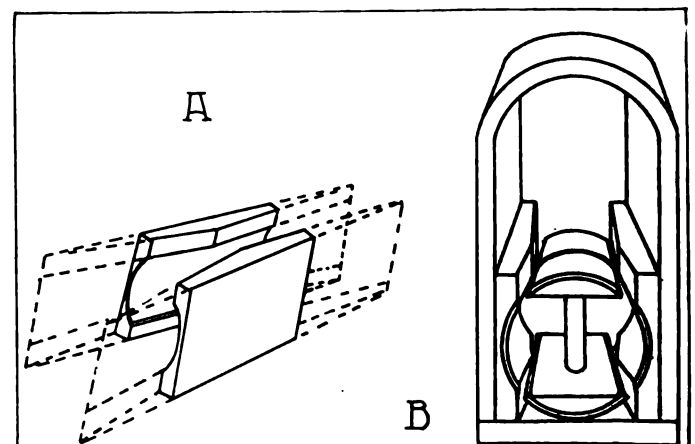
The platinum points of the two circuit breakers must be kept clean and correctly adjusted. The magneto breaker points should open about 1/64 of an inch, while those of the battery may be allowed to separate a trifle further.

The Type D C Coil.

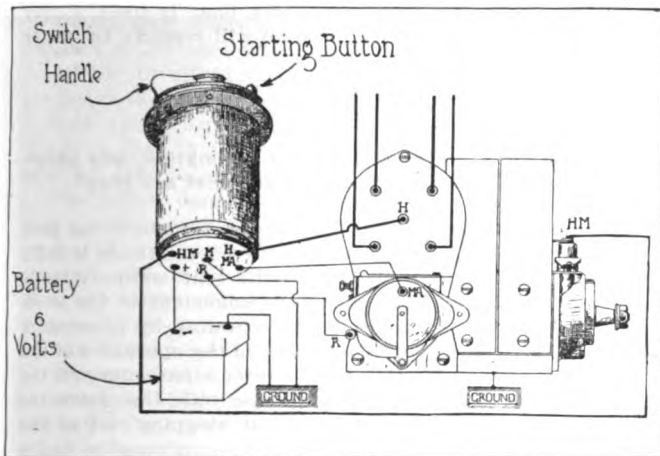
The type D C coil consists of a non-vibrating transformer and a switch which may be used to place either the battery or magneto ignition in operation. It is a compact cylindrical instrument and extends through the dashboard under the hood. The terminal connections are made to the side facing the motor. The end facing the operator contains the switch and starting mechanism. The push button circuit breaker mounted in the centre of the switch is designed to produce a spark in the cylinder with the battery current when the engine is not running.

The Correct Method of Timing.

As the spark is obtained when the primary circuit is broken, the magneto should therefore be set so that its



A, Shape of the Pole Pieces Used in Type E M Eisemann Magneto; B, Construction of Pole Pieces Prevents Isolation of the Armature at Any Time.



Wiring Diagram of the Type E M Elsemann Magneto for Dual Ignition; Wires Can Be Traced By Letters at Ends.

contact breaker will just be commencing to open when the piston in the cylinder is at top centre. A setting key, which is supplied with each magneto, greatly facilitates this operation. Before placing the magneto on the engine, retard it fully by pushing the timing lever as far as possible in the direction of rotation. Next turn the armature by hand until No. 1 appears at the peep hole on the top of the distributor plate. The setting key should now be inserted into the hole drilled into the gear casing of the magneto; it holds the armature rigid in this position. With the piston on dead firing point, the magneto is placed on the motor and the driving pinion or coupling made fast to the armature shaft of the magneto.

The Correspondence Department.

Description of the Dual Ignition System, Advantages of Divided Front Seats, How to Test and Adjust Wheel Bearings, Distinguishing Different Wires of the Ignition System.

DUAL IGNITION SYSTEM.

(W. E. B., Greene, R. I.)

Being a subscriber to your publication, I would like to have you answer the following questions: What is meant by a dual ignition system? Why is a coil used with a high tension magneto? What causes the gasoline to drain from the bottom of the carburetor when the engine is not running?

Dual ignition system is the term applied when two separate sources of current, such as magneto and battery, are used on a car. The battery is generally used for starting purposes and the magneto for general operating purposes.

The true high tension magneto requires no separate transformer coil; in fact the two could not be combined. In this type of instrument, it might be said that the coil is practically incorporated in the magneto. Its armature carries two windings, primary and secondary, and also a condenser. The current to the spark plugs is sent directly from the magneto.

If you have a car equipped with a transformer coil, the magneto is either of the low tension type or else a battery is used for starting. As you no doubt know, the current supplied by the battery is of low potential and must be stepped up to one of higher voltage before it is adapted to ignition purposes. The raising of potential is accomplished by the transformer coil.

Flooding or leaking of the carburetor when the engine is stopped is caused either by the gasoline level being too high or the needle valve not properly seating. It does not leak when the engine is running because the suction of the pistons carries the surplus fuel into the cylinders. There may be a little dirt that prevents the proper seating of the needle valve. If the level is too high, this can be caused by a wrong-

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ly adjusted or a leaky float. If a cork float is used, it may be gasoline soaked. A coat of shellac will remedy the latter condition.

DIVIDED FRONT SEAT.

(H. L. G., Tarklin, R. I.)

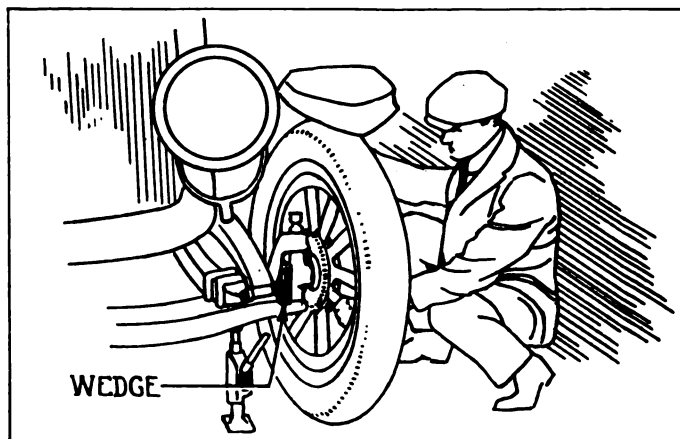
Has the divided front seat, in your estimation, any advantages over the undivided type, and if so, what are they?

No doubt you refer to the separate front seats being used in new models. Usually between the two seats there is sufficient space for a person to pass to the rear compartments. One of the chief advantages of this arrangement is the isolation of the driver. There can be no crowding by passengers and he is allowed to give constant care to the operation of the car. The space between the seats allows a passenger in the tonneau of the car to exchange places with the driver or another passenger in the front without stepping out of the car.

TESTING WHEEL BEARINGS.

(C. W. M., Wallingford, Conn.)

A little more than a year ago I purchased a new roadster, and recently I noticed that the front wheels had a tendency to wobble. My instruction book says that wobbling of the wheels can be remedied by adjusting the roller bearings. I did this and for a time the wheels seemed to be all right. However, they soon gave trouble again, wobbling more than they did before. When I removed the front wheels I found a broken roller bearing. Do you believe the bearing was defective? How do you test the bearings for play?



Wedges Placed Between Spindle and Axle Will Prevent Trouble When Testing Wheel Bearings for Play.

Without having the bearing at hand it is impossible to determine if it is defective. Judging from your letter it would appear that it was damaged through being improperly adjusted. If the adjustment was too close, the lubricant may not have been able to penetrate and overcome the friction. Consequently, scoring and breakage were the results.

There is a right way and wrong way to test the wheel bearings for play. The wheel should be jacked up and a piece of wood or other like material wedged between the spindle and axle, as shown in the accompanying illustration. This will prevent any movement of the steering knuckle on the king pin. Then grasp the wheel at top and bottom and try to rock it.

If the bearings are loose the lost motion can be taken up by removing the hub cap and screwing up the adjusting nut until the bearing is snug. Then this nut should be turned back about half a turn and locked. Next revolve the wheel slowly to determine that it turns freely and does not bind.

GENERAL INFORMATION.

(M. D. V., Brownsville, Tex.)

Kindly explain the following in your magazine:

The oilless bearings made by the Dann Spring Insert Company.

Why the American-made engines do not have as much power as those made in Europe?

Why an automobile cannot carry as much as it can pull when used as a tractor?

The oilless bearings made by the firm mentioned are designed to be used wherever there are moving parts. It is impossible to afford much enlightenment on this subject as the metal is made by a secret process. As the name would indicate, the bearings require no lubrication at any time. It is known that this metal has been tested by a railway company on large locomotives with signal success.

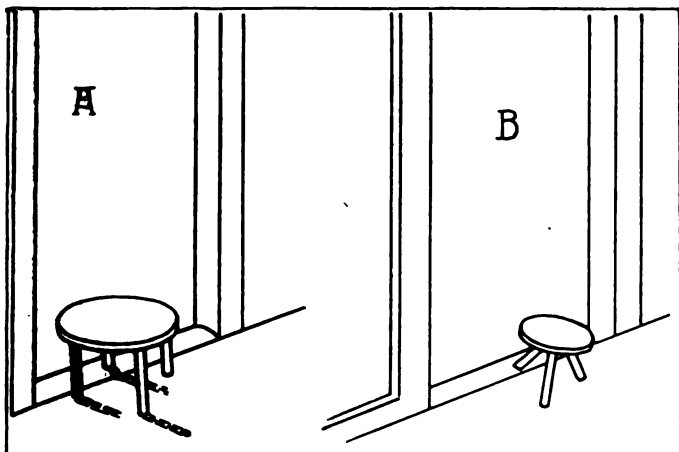
The writer does not know of it ever having been proven that the European engine will develop more power than an engine of the same design and size manufactured in this country. Of course design of a motor must be considered. Accurate workmanship will also cause a high development of power. There is no reason to believe that the European engine is more powerful than the modern American engine.

The automobile cannot carry as much as it can pull for the same reason that man or beast cannot carry as much as he can pull. On a level surface it is possible for a horse to pull a load of more than five tons. Now consider the result if this load was placed upon his back. His legs could not support it. This condition can be compared to the automobile. The construction of the machine is not such as to allow it to carry the load that it is capable of pulling.

THREE-POINT SUSPENSION.

(G. F. T., Owosco, Mich.)

I would like a little information about three-point suspension. What advantage has this method over the four-point method? I subscribed to The Automobile Journal recently and like the practical information you give.



Farmer's Milking Stool Affords Practical Illustration of Engine Suspension; A, Four-Legged Stool Placed On Uneven Surface Rests On Three Legs; B, Three-Legged Stool Rests On All Legs Regardless of Surface.

Consider the farmer's milking stool to learn the advantages of the three-point suspension of motors. At A in the accompanying illustration such a stool is shown, resting upon four legs. If the floor is uneven only three of the legs will be firmly seated, which will tend to disturb the equilibrium of any person sitting on it. At B will be seen a three-legged stool, which rests securely regardless of the unevenness of the floor.

In automobile practise the engine supports are to a certain extent flexible and if frame distortion is not too severe the stresses will not have serious effect. If the supports are a considerable distance apart, it is only reasonable to suppose that the distortion of the frame will be proportionately greater. For this reason some four-cylinder motor manufacturers use the four-point suspension with good results, but long four and six-cylinder engines are usually supported by the three-point system.

TESTING WIRES.

(G. E. B., East Greenwich, R. I.)

When overhauling my ——— touring car, I replaced the four primary wires leading from the coil to the commutator with new ones. These wires were tightly packed in a conduit and I carelessly inserted them without marking the ends. The result was that I had to remove the wires before I could distinguish the ends. Is there not some method of determin-

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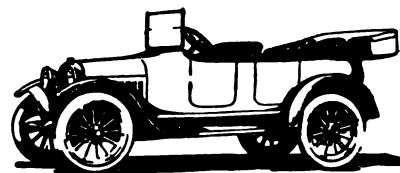
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ing the extremities of each wire when assembled in this manner? Will you publish this information in the Automobile Journal?

There are several simple methods for locating a wire when grouped in the manner you mention. If dry cells are used, one end of a wire should be connected to the negative pole of the battery. A separate wire should then be run from the positive pole of the battery to the positive of an ammeter. Next take the free ends of the cables in the conduit and connect them one at a time to the negative pole of the ammeter. The indicating pointer will move when the proper wire has been connected, as the circuit will be closed. The same method applies to a storage battery except that a voltmeter instead of an ammeter must be used.

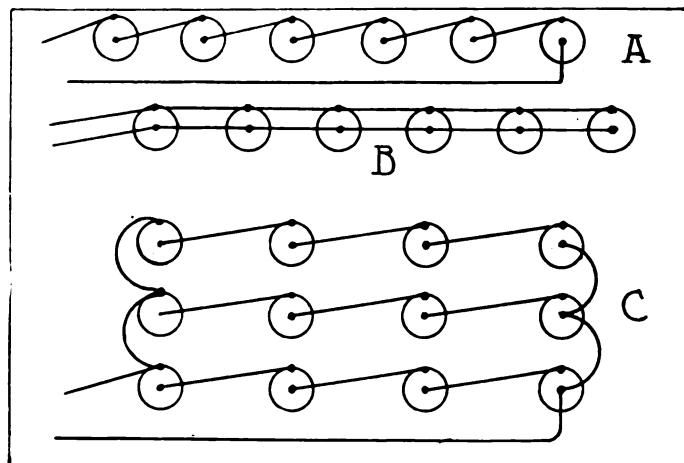
Another plan is to secure one lead to the zinc terminal of the battery and then rub the free ends of the wires at the other end of the tube on the carbon terminal of the battery. A faint spark will be seen when the circuit is closed.

Still another suggestion is to attach one end of any of the wires in the tube to the primary post on the coil. The free ends at the other extremity of the conduit are touched one at a time to any metal part of the engine. When the right wire is placed in contact, the coil vibrator will be placed in operation.

WIRING OF DRY CELLS.

(W. H. S., Methuen, Mass.)

At different times I have noticed reference made to series and multiple series methods of wiring batteries. State-



A, Dry Cells Connected in Series; B, Dry Cells Connected in Parallel; C, Wiring Groups of Cells in Multiple Series.

ment has been made that when dry cells are wired in multiple more current is obtained. If you can afford the space in your Reader's columns, will you kindly explain the difference between the methods and the reason for securing more current?

The ordinary dry cell will develop about 1.5 volts and has a capacity ranging from 15 to 23 amperes. To make this statement clear it will be well to explain that voltage represents the strength of the current and amperage the rate of flow. The average transformer coil used for ignition purposes utilizes a current of between six and eight volts. To obtain this the dry cells are connected in series, as shown in the accompanying illustration A. The current flows through the cells in succession, each increasing the voltage of the preceding cell by an amount equal to its own voltage. Connecting cells in this manner does not increase the amperage, but rather decreases it as the resistance is increased by the series connections.

If it is desired to increase the rate of flow, the dry cells are connected in parallel, as at B. All zinc terminals are connected in one group and all carbons in another. This arrangement does not make for increased voltage, it remaining the same as a single cell. The amperage is, however, increased by an amount equal to the product of the amperage of one cell multiplied by the number of cells used.

Groups of cells that are wired in series may be connected

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in parallel, as shown at C. This combination is termed series parallel or multiple series and may be considered as a single cell of large voltage. In the group shown, the voltage is equal to that of four cells connected in series and the amperage is equal to three times that supplied by one series group. When the cells are so arranged and connected to an outside circuit, the demand on each battery is one-half of that on a cell in a single series group.

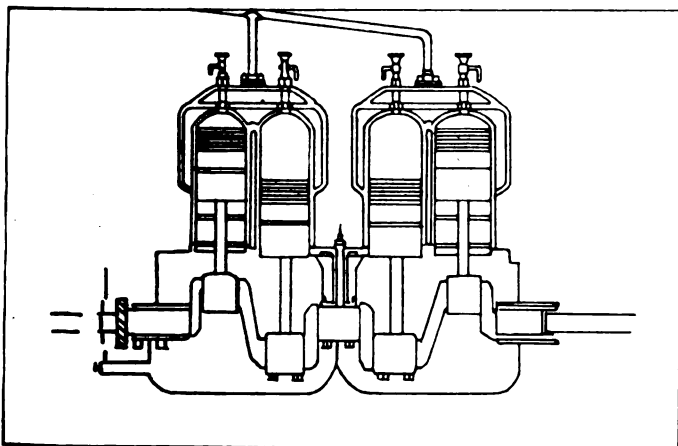
The advantage of connecting cells in multiple series is that the demand on the individual cells is reduced, thus increasing their life and at the same time obtaining the desired voltage. The greatest efficiency from dry cells is obtained when there is the lowest discharge rate in amperes.

FIRING ORDER OF CYLINDERS.

(E. R. Q., St. Albans, Vt.)

Why is it that in a four-cylinder, four-cycle motor the explosions occur in the order of 1, 2, 4, 3 or 1, 3, 4, 2 and not in the order of rotation, 1, 2, 3, 4?

The four-cylinder four-cycle motor is designed to produce power by a series of impulses and not by a lesser number of strong jerky explosions. The arrangement of the crankshaft is such that while one cylinder is firing, those next in rotation are compressing, exhausting and taking in a fresh charge of gas. When one piston has completed its power stroke, the piston which has just completed its compression stroke is ready to supply power to the shaft by the expansion of the gas in the cylinder.



Arrangement of Crankshaft Journals Is Such That the Two End Pistons Are Always at the Top When the Other Two Are at the Bottom of Their Strokes.

As shown in the accompanying illustration, two pistons are always at the top when the other two are at the bottom of their strokes. Instead of the explosions occurring in two cylinders simultaneously and then operating through three idle strokes before the deliverance of another power impulse, all pistons are spaced equally and a power impulse is delivered to the crankshaft at each half revolution. It will be noted that as two pistons are going up, the other two are going down, thus the parts are mechanically balanced. One set of moving parts weighs exactly the same as the other set.

Considering the motor referred to, the piston of No. 1 cylinder is at the top of its stroke ready for firing. The piston of No. 2 cylinder is at the bottom and ready to compress the fresh charge of gas. The piston of No. 3 cylinder is also at the bottom of its stroke and about to expel the burnt gases. The piston of No. 4 cylinder is at the height of its stroke and ready to descend for the intake of new gas. If the firing order of the motor was 1, 3, 4, 2, the only difference would be that No. 2 cylinder would be exhausting and No. 3 compressing, the reverse of when the firing takes place in the 1, 2, 4, 3, order.

BELT AND PULLEY TRANSMISSION.

(H. J. L., Freeport Me.)

Being a subscriber to your publication, I would like you to settle the following argument: A contends that the first form of transmission was chain drive; B is equally positive that the first form was belt drive. Which is correct?

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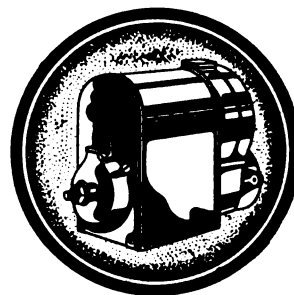
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B is correct. The early Daimler carriages used the belt transmission consisting of four pulleys regularly increasing in size and keyed to the main shaft. Four other pulleys decreasing in size in the same order were keyed to the countershaft. These eight pulleys were connected by four belts. The power was thrown on any one pair as desired, by tightening the belt with an idler pulley mounted on a suitably disposed bell crank. By this method it was possible to obtain four speeds forward on an even road, or to vary the power when ascending grades. No provision was made for reversing the car and the turn was made either by running around a complete circle or by pushing the car back by hand.

HANDLING GASOLINE SAFELY.

(C. F. T., Brockton, Mass.)

It is rumored that the government is issuing a pamphlet relative to the safe handling of gasoline. Is this true and to which department shall I apply?

The Bureau of Mines, Department of Agriculture, has issued a pamphlet containing suggestions that make for safety in housing and handling gasoline. These are based on exhaustive investigations conducted by the department, and should be considered seriously by every person having to do with motor vehicles or other power plants in which gasoline is used.

It is common practise among motorists and repair men to clean the engine with gasoline, because it readily cuts through oil and grease and evaporates quickly. The department points out that there is danger in this, because a spark is liable to be generated and cause disaster. A spark does not necessarily have to be produced by some electrical instrument; it will sometimes occur when two metals are struck together, such as hitting the edge of a nut with a wrench. Another habit to be discouraged is starting the motor so that the fan will direct a volume of air on the parts to dry them of gasoline—a stray spark may cause the car to be enveloped in flame.

When large quantities of inflammable liquids are used, the main supply should be stored in an underground tank, which is buried some distance from buildings. It should be pumped into the buildings as needed and the system should be such that all liquid will flow back into the storage tank when the pump is not in use. When a pumping system is not in vogue, the main supply should be kept under lock and key on the outside. Only a small quantity should be taken into the building at one time and it should be carried in closed metal cans.

When it is necessary to use an open pan, the opening should be as small as possible. When not in use, place a cover over it. Only electric lights having guards over them to prevent their being broken should be employed. Prohibit the use of any type of open light. Signs of warning conspicuously placed will communicate to all the danger of carrying open lights about the building. These signs should explain the danger and give instructions for the safe handling of the fuel.

Rooms in which the ignitable fluid is stored or used should be safely inclosed and amply ventilated. Keep all joints in tanks, pipes, conveyors, etc., tight. When work is to be done on any vessel in which gasoline has been stored, make sure that all gasoline vapor is removed before commencing. Force the vapor out with a body of steam or air under pressure.

Sufficient ventilation is the secret of preventing fires when gasoline is being used. It has been found by test that if a match was applied to an open pail filled with it, the fluid will only flare up and burn as long as the supply lasts. If a few drops were placed in a tightly inclosed receptacle and after a few minutes an electric spark introduced, a violent explosion would take place. In the first instance, the vapor burns as fast as it is cast off and mixes with the oxygen in the air. In the second case, the gasoline vaporizes and mixes uniformly with the air.

One gallon of gasoline when entirely evaporized produces approximately 32 cubic inches of vapor. If a naked flame could be applied to pure gasoline vapor in the absence of air, no fire or explosion would result.

Gasoline vapor requires to be mixed with a certain proportion of oxygen before an explosion will take place. Tests have shown that in a 100 parts by volume of air and gasoline, an explosion will not take place if there is less than 1.4 parts

of gasoline vapor or more than six parts. Flashes of flame will appear when the mixture contains considerably smaller and larger percentages. Considerable pressure will be developed, but complete propagation will not take place.

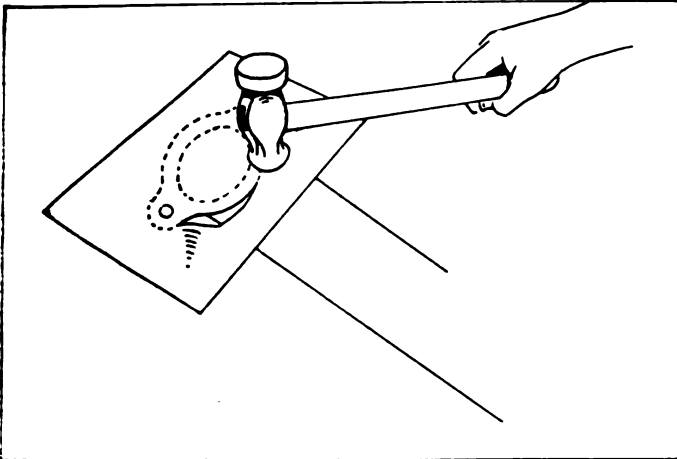
When an open pail is first filled with gasoline, a small volume of vapor forms over the surface of the liquid. Just above this layer of pure gasoline vapor is a mixture of vapor and air. At some point there will be an explosive proportion, still further away there will be a small proportion of vapor and still further away there will be only pure air.

Gasoline vapor forms rapidly and thus renders the surrounding air, a little at a time, inflammable and explosive. If there is no ventilation a dangerous atmosphere will fill the entire room in a very short time.

There are two principal methods of extinguishing burning liquids. The first is to shut off the supply of oxygen from the flame by a blanket of gas or solid material. The second is to dilute the burning fluid with a non-inflammable extinguishing agent that will mix with it.

Water has no value as an extinguishing agent for liquid fires. To the contrary, it tends to enlarge the area of the flame. Sand, sawdust, carbon tetrachloride and the so-called foam mixtures are some of the materials generally used to smother the flame.

Sawdust is particularly good because it will float for some time on the surface of the liquid and shut off the oxygen. It is not easily ignitable, and when it does burn it does so without flame. Sand has about the same value as sawdust. It is the heavier, however, and sinks quickly, whereas sawdust



Method of Cutting Asbestos Gasket by Tapping the Sharp Edges of the Manifold with a Hammer.

floats. An ordinary blanket will often serve to extinguish a small fire of burning gasoline.

CUTTING ASBESTOS GASKETS. (W. K., Portland, Me.)

What is the best method for cutting an asbestos gasket to fit a manifold joint? I have a ——— car and while making some repairs on it, attempted to cut a gasket from a sheet of asbestos with a knife. Due to crumpling and tearing of the material, much of it was wasted before I was successful.

Asbestos, especially if thin, is difficult to handle unless the workman is experienced. With a pair of shears, cut a piece of the desired thickness and slightly larger than the end of the manifold and place it over the opening, as shown in the accompanying illustration. The sharp edges of the manifold end should then be tapped lightly with a ball peen hammer. The blows will cause the sharp edges to cut through the asbestos and the gasket proper will be easily separated from the piece.

If the manifold is made of aluminum, care must be taken when tapping, as it is easily broken. Before fitting coat both sides of the gasket with a mixture of flake graphite and oil. Besides assisting in sealing the joint, the graphite will permit the removing of the gasket without damage should it ever be necessary to take off the manifold at any time. If one thickness of the asbestos is not sufficient for sealing the joint, two gaskets may be joined together with shellac and the exterior surfaces graphited.

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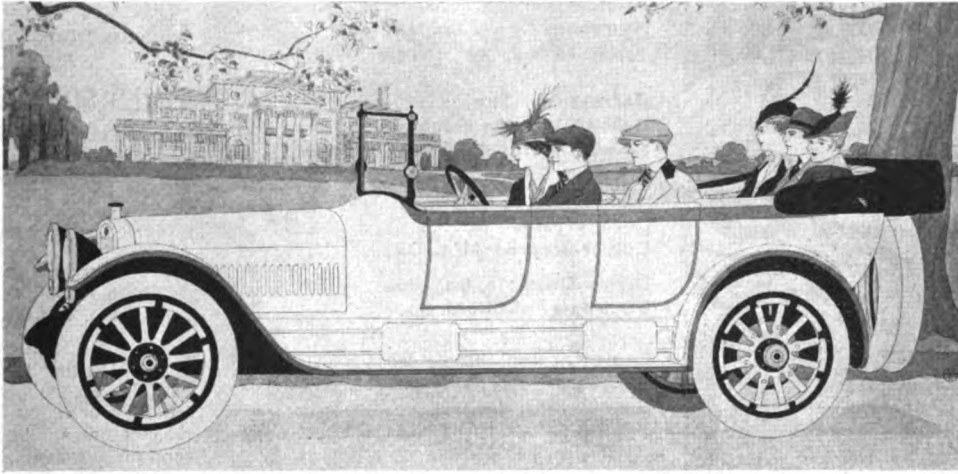
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Entered as second class matter, April 15, 1906, at the Postoffice at Pawtucket, R. I., under Act of Congress of March 3, 1879

VOL. XLI.

APRIL 10, 1916.

NO. 5.

The Publisher's Comments.

AT LEAST One Benefit has been brought about by the high cost of gasoline—the majority of motorists have been compelled to economize in its use as a fuel and it is a lesson which should not be forgotten when the price has been returned to the old levels. The average operator does not realize how he wastes fuel, or rather how much can be saved by careful operation. As an instance of waste, a driver will leave his car at the curb with the engine idling, or possibly racing. It is cheaper to stop the motor. While the amount thus saved is small in itself, the aggregate will be considerable at the end of the year if the precaution is taken each time.

The Economical Operator will attend to leaky connections and piston rings, remove carbon from the cylinders, adjust the carburetor to meet varying conditions, see that the ignition, lubrication and cooling systems are functioning properly, and otherwise take those precautions which make for lessened consumption of gasoline. Some drivers can get as much value out of a gallon of fuel at 40 cents per gallon as others could out of the same quantity at 10 cents. How this is done is explained in non-technical language in the Automobile Mechanical book entitled "Operation," which will be sent to subscribers on receipt of 50 cents.

The May 10 Issue of this magazine will be the Annual Overhauling and Car Equipment Number, one of the most valuable editions of the year. It will contain explicit information concerning the preparation and repair of cars and supply that kind of data which every operator needs to obtain perfect service from the machine during the coming season. An added feature of this number will be the department devoted to descriptions and illustrations of car accessories and general equipment.

Complete Specifications of all the Commercial Motor Vehicles now being manufactured are contained in the April number of Motor Truck and form the most valuable library of information on the subject that has ever been published. The data are conveniently arranged and classified for quick reference and are exceptionally complete in all details. Every type of commercial vehicle—gasoline and electric trucks, trailers and tractors—are included in the specifications. Those readers desiring copies of this number of Motor Truck should send their orders to this office immediately.

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*Bad Brakes and a Skid May Have
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Facts About Car Insurance.

NOT long ago, while a physician was driving a motor car down a steep hill in Providence, R. I., a poorly dressed man stepped into the road from the curb and deliberately placed his foot so as to be run over by one of the front wheels. Then he cried out as though he were in great pain.

It was evident at once that he was determined to be injured by a motor car and the driver was instantly on guard. It happened that a policeman standing nearby had seen what had occurred. He and the doctor insisted on taking the man at once to a large hospital, where he was examined.

There it was found that he had not been injured. Yet suit was brought against the physician for personal injuries, and as the case was hotly contested by the insurance company which had written liability insurance for the driver, it ultimately was dropped by the claimant.

It is evident that the physician, who was in no way to blame for what had happened, might have been put to great trouble and expense in securing witnesses, conferring with lawyers and fighting the suit if he had not been insured. The superior efficiency of the insurance company at that kind of work probably enabled it to handle the matter more successfully than he could have done. And certain-

ly the physician was saved a great deal of time and much worry by the action of the insurance company.

While, of course, there are not many people who are deliberately trying to work up an accident case against a motorist, persons are frequently accidentally injured by motor cars and almost every injury means either a settlement or a damage suit. So liability insurance is a very vital thing for the motorist who has other property besides his car which might be taken from him in a suit for damages.

Personal injury liability is the most uncertain risk the motor car owner has to bear. The damages he may be called upon to pay as the result of an accident may be any amount from \$50 to many thousands. If he injures a laborer he may be able to settle for a relatively small sum; if he injures a

bank president, who will be represented by highly skilled lawyers and whose time and working capacity will be valued more highly by the court, the damages may amount to several thousands of dollars.

The motorist, therefore, who fails to protect himself with liability insurance puts his bank account, his home and even his house furnishings in jeopardy. If he is a busy man he cannot afford in view of the low cost of liability insurance, to spend



Fire Is a Hazard Which the Car Owner Constantly Faces.

the time that is necessary to settle such cases. He needs a service that will assume all the details of settlement.

If he is covered by insurance he needs only to telephone the agent, or mail a blank giving the details of the accident, and he need worry no further concerning the matter. Liability insurance of this type is written by the casualty insurance companies and is one of the most vital of the various sorts of insurance that is offered the motorist.

Substantially all of the policies of this nature take what is known as the standard limits and this provides protection for one injured person to the extent of \$5000 and for two or more injured persons \$10,000, with the limit of \$5000 to one person and \$10,000 in one accident. If the damages assessed in the court are greater the insured must stand the difference himself. Higher limits of coverage may be had at a higher premium.

It should also be noted that liability insurance applies not to the car, but to the person whose name appears in the policy as the assured. Thus if a car is loaned and an accident occurs, the person driving it is responsible for the damages and is not covered by the owner's policy.

For this reason an owner who has a family, different members of which often drive the car, will find it advisable to have their liability covered as well. One additional person is covered at an increase of 10 per cent. in the premium, two for 12½ per cent. increase, and three or more for 15 per cent. additional.

Since workmen's compensation laws were put in force in

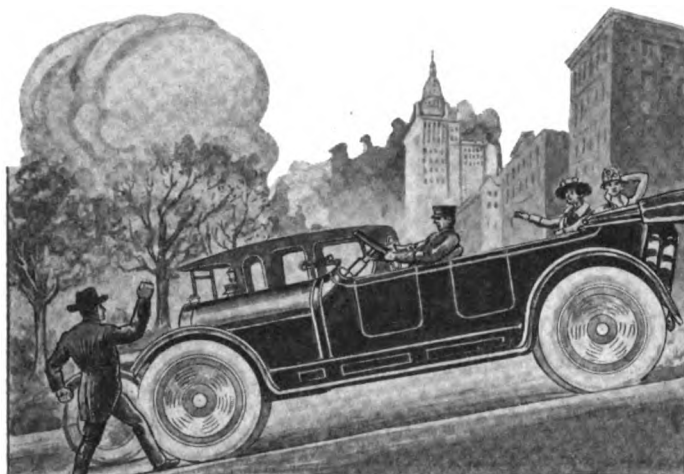
losses. If a man had an old car which he could get insured for its full value or more, it would be possible for him to get a new one by running the old machine into a stone wall and collect the damages from the insurance company.

So in writing such policies great care is taken in regard to the character of the insured, and to see that the value placed on the car is conservative. Men given to wild joy rides find it difficult to get this sort of insurance, or for that matter, personal injury liability protection.

It is not so essential to the owner of the light, inexpensive car as some of the other types of coverage, but in the case of expensive cars and especially of closed cars on which costly body work may be necessary after an accident, it is highly desirable.

The policies are of two types. One is known as full coverage, which protects the owner from injuries to his car from one cent upward. The other is the \$25 deductible average policy which places \$25 of the loss on the owner of the car no matter how great is the amount. In this latter form minor accidents are never called to the attention of the company, which thus escapes a great deal of expense for service work of one kind or another. The certainty of a \$25 loss serves to make the insured more careful and to reduce "moral hazard."

Fire and theft insurance is written in a single policy by the fire insurance companies. Fire insurance covers all losses from one cent up, but theft insurance covers only such losses to the car and its accessories amounting to more than \$25, and that does not apply to the loss of coats or robes.



This Man Deliberately Sought to Be Slightly Injured in Order to Bring a Damage Suit.

a majority of the states, a certain class of lawyers, generally known as "ambulance chasers," have had a great amount of business taken away from them in personal injury suits between employee and employer. The result is they have turned their attention to a greater extent to automobile accidents, and cases of that sort are multiplying—a fact that makes liability insurance of more importance.

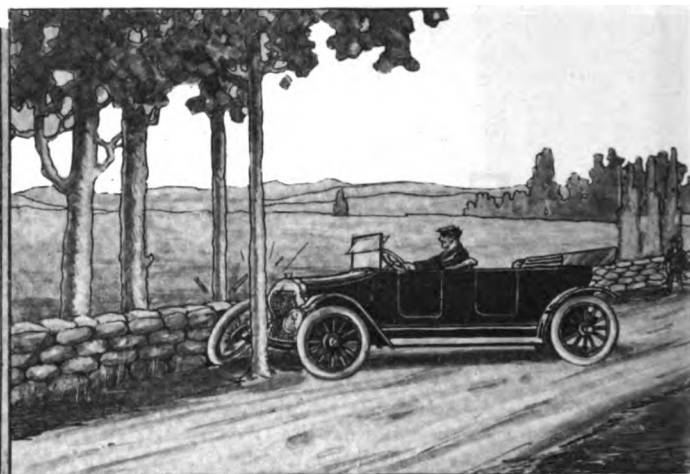
The casualty companies also write insurance for property damage which covers liability for damage to the property of third parties. This costs only about one-third as much as personal injury liability and the risks it covers are correspondingly smaller.

In the case of a light car, property damage resulting from operation is never serious. It can always be settled by paying a repair bill, and the value of the property destroyed can usually be estimated readily and immediately by a person of ordinary information.

Heavy cars are capable of inflicting greater damage and many owners find it profitable to carry that sort of insurance. With trucks it is very necessary for a heavily laden truck may break away and cause rather serious injury to store fronts, poles, motor cars or other forms of property.

Hazard in Collision Insurance.

A third type of insurance written by casualty companies is collision insurance. This covers damages to the car driven by the person insured. Many companies are not especially anxious to write this type of insurance, as "moral hazard" is believed by many insurance men to be a big factor in the

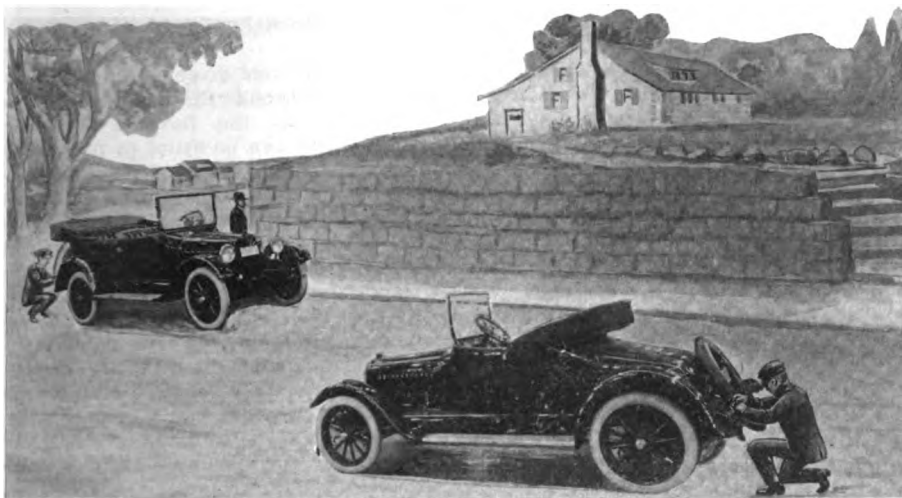


Collisions Are Sometimes Unavoidable, but Financial Protection Is Afforded by Insurance.

Rates for these types of insurance are a percentage of the amount for which the cars are insured. The policies are of two types known as valued and non-valued. In the valued policy the company agrees that the value of the car is the amount stated in the policy, while the non-valued allows for depreciation and, in fact, puts it in the hands of the company to decide the value of the car after fire or theft has occurred. The valued policy gives much less opportunity for misunderstanding or dissatisfaction when a loss has occurred. In any case the insurance covers only the loss actually sustained and not the full amount of the policy, unless the car is a total loss.

The rates are lower on new cars than on old, and as cars increase in age the amount of insurance that the company will write upon them decreases. There has been so much stealing of light cars that some companies refuse now to write theft insurance upon them, or, if they do write it, they insert a condition that a lock must be used. If, after it has been stolen, the company can show that the lock was not in use at the time it escapes all liability. In general, it is best to have a policy with as few such conditions attached as possible, since each condition if it is not fully understood by the insured gives rise to possibilities of dissatisfaction and disappointment when a loss has occurred.

Rates for automobile insurance are set by two conferences of insurance company representatives, both of which meet in New York City. They include all or nearly all of the companies in the business and the rates apply to all the business written in the United States except in states where "anti-trust" laws prohibit co-operative rate making.



Thieves Are Often More Interested in Tires and Accessories Than in the Car Itself.

The conference of the casualty companies, which sets the liability rates, is known as the Workmen's Compensation Service Bureau of New York, because of the fact that the same companies deal largely in workmen's compensation insurance. Fire and theft rates are similarly fixed by the Automobile Underwriters Conference, which is composed of fire and marine insurance companies.

The rates are based on the experience of the companies which are members of the conference—that is the proportion of the premium payments that have been paid out in losses over a considerable period. Calls are frequently sent out for experience and the rates that are set may remain in force for only a few months, or for several years, according to whether or not changing conditions become evident in the experience records of the companies.

Many Factors in Rate Making.

A great many factors, determined by expert insurance analysts, enter into the making of rates on a particular car. One of these is the locality in which the car is most used. Thus the liability companies divide the country into several districts for rate making.

One schedule applies to Greater New York, Nassau county, Long Island and part of Westchester county. Another applies to St. Louis, Boston and the 19 adjoining towns, Providence and the counties of Providence, Kent and Bristol. The third schedule covers all the remaining territory in the United States, while schedule four deals with innumerable exceptions to schedule three in which rates are either raised or lowered.

The first schedule for New York carries the highest rate, the second the next highest and the third next, while the rates set by the fourth are both higher and lower than those of the third.

For fire and theft insurance the country is divided into departments, known as New England, New York, western, southeastern and Pacific Coast. The rates in all are very nearly alike.

Theoretically the rates are the same for all companies in the same territories, but in this, as in other businesses, the pressure of competition causes some breaking of rates. Agents sometimes do this by such devices as writing policies for cars owned in the higher rate territories as though they were owned elsewhere. Thus it was charged recently that many agents in New York City, where the rate is highest, were selling to their customers policies in which the location of the car was described as outside of the city in the low rate territory. Effort has been made by the companies to end this condition, but all forms of rate cutting are hard to stop.

Sometimes agents also make an ap-

pearance of offering a lower price than their competitors to the not fully informed car owner by suggesting a policy that is more limited in its coverage. In the main, however, the rates of the companies are the same and the chief points the buyer of insurance should interest himself in are the standing of the company and the standing of the agent that writes the insurance. The more business the agent does the more he will know about the business, and the better he will be able to serve his customers. Also, he will have greater influence with his company, which he may use, in case of loss, to see that his customer gets entirely satisfactory treatment from the company. A few of the agents do their own adjusting when losses must be settled.

In addition to location there are several other factors that determine liability rates on automobiles. The kind of power used is one. Electric pleasure vehicles are better risks than gasoline and the rate on all of them is the same. The rate on gasoline passenger cars depends on the horsepower. The National Automobile Chamber of Commerce formula is used to determine it, and the larger the horsepower the higher the rate. Private passenger cars take a lower rate than public cars, such as taxis and jitneys, livery cars, or commercial vehicles. In fact, taxicabs, jitneys and most livery cars are regarded by many companies as uninsurable risks, though a few quote very high premium rates upon them. The reason is that they are usually operated at great speed in order to secure the highest possible return on the investment. They are on the move in traffic a much greater portion of the time than private cars and are more liable to accidents.

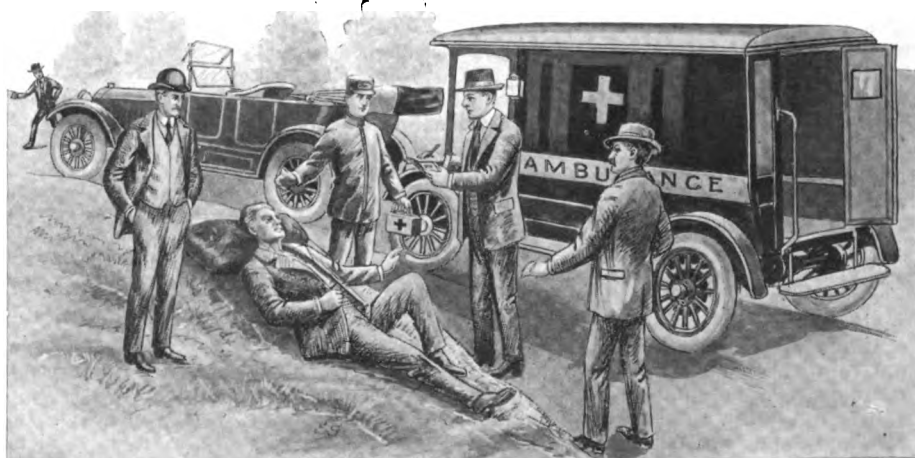
These cars are undesirable fire risks also because they depreciate so rapidly that the element of moral hazard may become large before the policy expires.

For liability insurance there is a wide variety of classifications for commercial vehicles, depending largely upon the type of work in which they are employed. There are five classes and each of these is divided into two sub-divisions, known as A and B. The rate corresponds to the experience of the companies with regard to the number of accidents in the different kinds of employment.

In some places the idea of co-operative insurance for motor car owners is making headway and mutual companies are being organized to save the car owner the profits which are made from the business by the old line companies.

This plan affords an annual return of a certain portion of the standard premium to the insured in the form of a dividend, but it is opposed on the ground that the companies have no such surplus funds as the great companies and a bad fire entailing very heavy losses might make the company insolvent.

It is noticeable, however, that the American Association



When an Accident Occurs Some Lawyer May Endeavor to Establish Responsibility.

of Garage Owners has recently started an insurance exchange for its members in the expectation, based on experience in other trades, that the losses to be paid will amount to from 25 to 35 per cent. of the premium, while the cost of competent management of the insurance business will amount to 25 per cent., leaving from 40 to 50 per cent. to be returned to the insured.

Motorists inaugurated such a plan of co-operative insurance last year in Pennsylvania where the Pennsylvania Indemnity Exchange was established. It covers the Automobile Club of Philadelphia and the club is active in forwarding its interests. The organization is growing rapidly and has now opened branches in Pittsburg, Erie, Harrisburg and Lancaster, and established agencies in other parts of the state.

Such a company also operates in Providence, R. I., with much success. It is very important in this sort of insurance that the risks should be carefully selected and should be arranged so that wholesale losses cannot be inflicted. While fire losses may be very heavy in a single locality, because of the burning of a town or of a large garage, liability losses cannot well accumulate in that way, and the plan is probably better adapted to that sort of insurance.

The growth in the volume of business done by the liability companies, as well as the percentage of premiums paid out in losses is shown by the following tables from Best's Insurance Reports:

Aetna Accident and Liability Company.

Year	Premiums Received	Losses Paid	Ratio Per Cent.
1910.....	\$282,341	\$131,980	48.7
1911.....	338,108	145,540	45.3
1912.....	439,744	135,676	33.0
1913.....	612,654	196,349	34.0
1914.....	688,668	266,178	38.6

Travellers Indemnity Company.

Year	Premiums Received	Losses Paid	Ratio Per Cent.
1910.....	\$318,826	\$171,313	53.7
1911.....	444,014	206,180	46.4
1912.....	535,676	209,442	39.1
1913.....	573,678	259,554	45.2
1914.....	625,393	273,210	43.7

Massachusetts Bonding and Insurance Company.

Year	Premiums Received	Losses Paid	Ratio Per Cent.
1912.....	\$22,538	\$2,876	12.8
1913.....	52,685	16,498	31.3
1914.....	70,518	34,552	49.0

Maryland Casualty Company.

Year	Premiums Received	Losses Paid	Ratio Per Cent.
1910.....	\$44,051	\$14,426	32.7
1911.....	98,954	24,424	24.7
1912.....	140,949	52,748	37.4
1913.....	151,165	60,084	39.7
1914.....	162,080	58,699	36.2

NEW MASSACHUSETTS LAWS.

Governor McCall of Massachusetts has signed a bill calling for lights on all vehicles from half an hour after sunset to half an hour before sunrise. This regulation was formerly in effect with regard to automobiles but other vehicles were not forced to light up until an hour after sunset.

He also signed a law permitting motorists in other states who live within 15 miles of the Massachusetts border to register their cars in the state for a fee of \$2. This law is also in force in New Hampshire and Maine, where similar privileges are extended to states which reciprocate. It will enable Massachusetts business houses to make deliveries over the state line.

TIB INFORMATION IN DEMAND.

With the coming of warm, bright weather, there is a great revival of interest in touring. A large demand for touring information is being supplied by the Touring Information Bureau, Shukert building, Kansas City, Mo., which issues a national route book covering main travelled highways from coast to coast and in addition state route books covering Kansas-Missouri, Minnesota-Wisconsin, Indiana-Illinois, Iowa-Nebraska and Colorado. It lays out special tours on request and supplies all information regarding roads, supply stations and hotels.

LITTLE WONDER VAPORIZING VALVE.

Very large increase of mileage from given volumes of gasoline is the direct result claimed through the use of the Little Wonder vaporizing valve, made by the Burgess Specialty Company, Providence, R. I., which can be fitted to practically any type of automobile engine. With the retail price of gasoline frequently in excess of 100 per cent. more than was charged eight months ago, and with the quality somewhat lower, the only practical economy for the owner is to so conserve the fuel consumed that greater mileage can be obtained.

The Little Wonder vaporizing valve is a scientifically designed device that is fitted to the intake manifold of the engine, by which a predetermined volume of warm, moist air is admitted to the manifold, thus reducing the quantity of gasoline flowing through the carburetor and, because of the more perfect vaporization of the fuel, producing a gas that is entirely consumed.

The automobilist should understand that he does not burn gasoline, but a gas composed of definite proportions of gasoline vapor and air, and when the mixture can be wholly consumed the greater power is obtained and waste is obviated. Claim is made that during a series of tests made with different cars during January and February of this year, a saving that averaged 44.3 was obtained—that is, the mileage was increased nearly a half.

In a dynamometer test conducted under the auspices of and by a representative of the Society of Automobile Engineers, and the agent of one of the best known carburetor manufacturing concerns of America, with the Little Wonder vaporizing valve, a saving of 37.5 per cent. was made with a four-cylinder engine car, 41.8 with a six-cylinder engine car, and 42.2 per cent. with an eight-cylinder engine car, and the power increase ranged from 18 to 34 per cent.

The device is sold by the manufacturer with the guarantee that if, after it has been given a thorough trial, satisfaction is not obtained, the purchase price will be refunded, and this applies to every sale made by a jobber or dealer. The valve can be installed in a very few minutes and is entirely automatic, requiring no attention whatever. There is nothing that can wear and the device will serve practically an unlimited period. It is sold by all dealers or jobbers or direct by the manufacturer.

CHICAGO USED CAR SHOW.

The Chicago Automobile Dealers' Association, which took the first active steps to clear up the used car situation by publishing a report of the actual prices at which such cars were selling in order to standardize the market, has taken another step forward by holding a used car show.

Sanction has been secured from the National Automobile Chamber of Commerce by E. G. Westlake, who is in charge of the show. It will be held in the Coliseum, May 8 to 15. About 80 dealers will be represented, constituting 95 per cent. of the representatives in that territory.

A public drawing for space will be held and arrangements will be made so that cars sold during the show can be removed from the floor and replaced by others.

SUNDAY GASOLINE SALES.

The Massachusetts Senate "killed" the bill which would legalize the sale of gasoline and motor car supplies in the state on Sundays and refused to reconsider its action in a vote taken April 3. It also refused to repeal a law which prevents the sale of meals without liquor on Sunday. These laws, however, have not been enforced in Massachusetts and probably will not be.

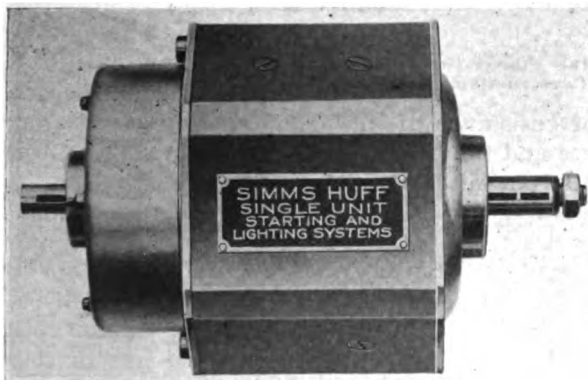
HENDERSON TO DRIVE MAXWELL.

George Henderson, otherwise known as "Pete," will drive one of the Maxwell racing cars of the Prest-O-Lite team, which is to be managed by Eddie Rickenbacher, and will appear first in the Memorial Day race at the Indianapolis speedway. Henderson is a Canadian, who has spent a good deal of time in the United States. He made an excellent showing in recent racing events at the wheel of a Duesenberg car.

MOTOR STARTING AND CAR LIGHTING.

The Simms-Huff Single-Unit System, the Machine Charging the Battery with Six Volts Current, and Drawing 12 Volts when Turning the Engine.

ESPECIALLY interesting is the Simms-Huff single-unit system, which is built by the Simms Magneto Company, East Orange, N. J., which has several characteristics that are pecu-



The Motor-Generator of the Simms-Huff Single Unit System, the Armature Shaft Being Designed for Coupling at Either End.

liar to itself. Claim is made for this system that it is extremely efficient, and with its light weight the maker maintains that it is well suited for all vehicles of moderate or small power. The design and construction differ somewhat from the systems that have been previously dealt with, but there is no departure from conventional practise so far as the applications of principles are concerned.

The manner of installation, however, is not common, because the machine may be coupled at either end. That is, it is fitted with an automatic mechanical and electrical coupling and it drives the engine through a pinion that is slidable on a jackshaft so that it may be meshed with or unmeshed with a pinion on the armature shaft and an external ring gear mounted on the fly-wheel, and as a generator it is driven by an extension of the armature shaft carrying a pulley by a belt that drives the fan of the cooling system from a pulley on the forward end of the engine crankshaft.

From this statement one will understand that the machine is mounted at the rear of the engine with the jackshaft and the pinion and external gear housed, and the armature shaft extension is connected with a flexible coupling that insures against misalignment and side pressure upon the main bearings of the motor-generator.

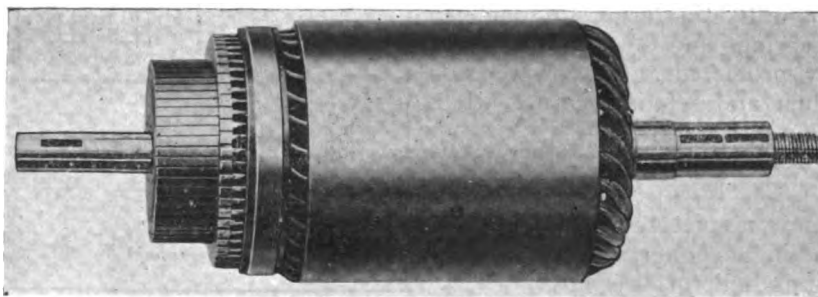
The machine has an unusual

characteristic in that as a generator it will not begin charging until the engine speed is equivalent to 12 miles an hour on the high gear, and the maximum is reached when this engine speed is equal to 13 miles an hour, the range being ordinarily 10 amperes, and this output of current is continued without variance, no matter how much in excess of 13 miles an hour the car is driven. This means that the current is quickly developed and that it is maintained practically at a standard so long as the vehicle is driven 13 miles or more. This insures the greatest productiveness of the generator at comparatively low speed and efficient charging when the machine is being used where there is constant need of all the lights.

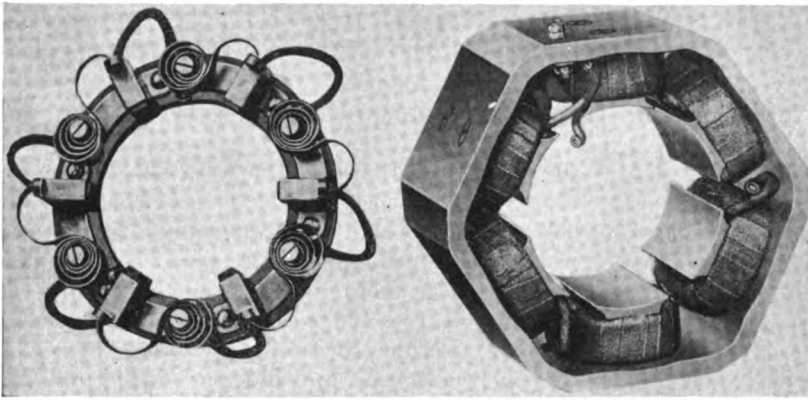
The generator is small and compact and is housed in a hexagonal case or frame of cast steel, this form being well suited to substantial installation and it may be secured to any bracket without special fittings or radical change of the engine case. This housing is a shell of metal to which the six pole pieces or shoes are attached by two screws each. The end plate for the pinion end of the generator is formed with a large boss with a convex base in the centre, which carries the main bearing, and the commutator end is enclosed in a heavy spider that carries the main bearing. This spider is housed by a deep aluminum cover that is screwed to the frame. Removing these screws and withdrawing the cover will expose the spider and the commutator, so that the brushes can be easily examined or tested.

The frame is cast steel and carefully machined and end plates and spiders are very accurately worked and fitted. Six pole pieces are formed with wide concave heads and comparatively broad side "horns" so that when installed the fields are close together. The pole pieces are designed to prevent "humming" and to obtain full magnetic saturation of the armature. They are carefully ground all over to exact size.

The pole coils are shaped on forms and are heavy copper wire, substantially insulated with



The Drum Type Armature, Which Is Constructed Without Binding, the Insulation, Which Is Ground to Size, Retaining the Windings.



The Brush Holder (at Left) and the Frame (at Right) of the Simms-Huff Single-Unit Starting System, Showing the Simplicity of Construction.

cotton fabric. The coils, after they are formed and covered with fabric, are thoroughly impregnated with an insulating compound under vacuum and compression pressures, and are baked, this insuring the greatest protection and the exclusion of all moisture. This process makes all metal posts and windings water proof and fully resistive to high electrical pressures. But one field coil is brought out.

Armature a Drum Type.

The armature is a drum type, this having a heat treated chrome nickel steel shaft and the core is composed of a series of notched discs of soft iron so assembled that there are longitudinal slots or channels extending its length. These discs are perfectly insulated from each other. The windings are carried in these slots, but the construction is such that no binding bands are used, the wiring being effectively retained in the slots, no matter what the centrifugal force resulting from the speed of the machine.

The commutator is large and is constructed of segments of hard drawn copper of great conductivity that are insulated from each other by mica sheets. The segments and the wiring are soldered by a dipping process that insures strength. The entire assembly is thoroughly impregnated with an insulating compound under alternate vacuum and compression pressures and is baked. The armature is completed by grinding to size, this insuring positive accuracy of balance. The armature shaft is mounted in large annular ball bearings and these are effectively protected against water and dust and seldom require attention.

Construction of Brush Holder.

The brush holder or rigging is a one-piece construction with a single connection brought out. It is built of alternate layers of insulation and metal rings. As there are six poles and field coils

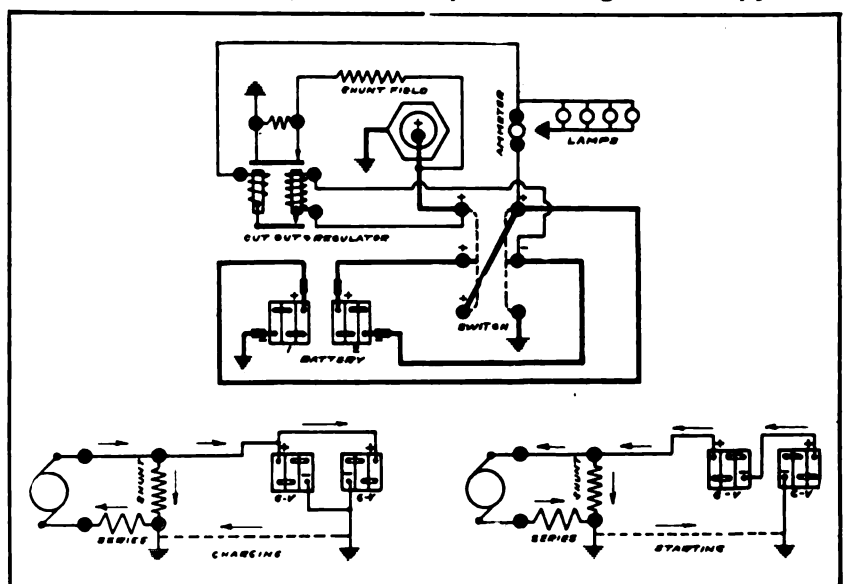
there are six brushes that are mounted 60 degrees apart between centres, and equi-distant and between the brushes are studs that carry the brush springs. On these studs are springs composed of four turns or convolutions of flat metal that, because of the form, have the same tension on the brushes irrespective of the length of the brushes. These brushes are composed of a special high conductivity and high resistance copper-carbon, graphite.

Much care is taken to insure the resistance of the insulation. Both the armature and the brushes and holders are tested with 110 volts alternating current, although they are required to endure but 12 volts in ordinary service.

Battery Has Six Cells.

The machine is operated with a six-cell battery, which is charged at the rate of six volts, the battery being divided into two sets of cells, each having a voltage of six, the sets being arranged in parallel. When the battery is being charged the generator is in effect a differential dynamo, the two fields opposing each other, so that the terminal voltage and consequently the charging current are not excessive at high speeds.

When the machine is operated as a motor the battery cells are arranged in series, so that it draws a current of 12 volts, and as this is passed through the series and shunt windings it is a compound motor in effect. The motor-generator is equipped with but two distinct connections, the one at the bottom of the forward end plate and the other on the top of the field yoke, which are hose being termed "Dyn" and "Field" respectively. As the system is a grounded type, the



The Wiring Diagrams of the System: Above, the Means of Regulating the Charging and Discharging; Below, at Left, the Circuit in Parallel; at Right, the Circuit in Series.

opposite sides of the circuits are grounded within the frame.

The Means of Regulation.

The machine is regulated by a combined electromagnetic cut out and regulator that has four terminals, which are indicated on the accompanying wiring diagram. Looking at the terminal side of the unit the cut out coil and contacts are at the left and the regulator coil and contacts are at the right. The coil of the resistance wire carried back of the cut out and regulator coils is placed in circuit with the shunt generator field. When the contacts on top of the regulator coil are held together by a spring with the engine idle or running at low speed, the field current passes through these contacts and does not go to the resistance coil.

The winding of the regulator magnet is connected in series with generator and battery so that, as the speed and amperage of the generator rises, the strength of the regulator magnet increases. At the point determined by the tension of the regulator spring the strength of the regulator magnet overcomes the tension of the spring and the contacts separate, which action causes the shunt field current to flow through the resistance coil and to be immediately reduced in value. This decreases the generator output and prevents the amperage rising above the point determined by the regulator adjustment. Turning the regulator spring down or toward the right increases the spring tension and increases the generator output, and turning it toward the left decreases the current production. The cut out is adjusted by a screw through the flat spring on top of the cut out magnet. Turning this screw down, or toward the right, increases the spring tension and raises the engine speed at which the cut out will close, and turning the screw toward the left lessens the engine speed at which the cut out will operate.

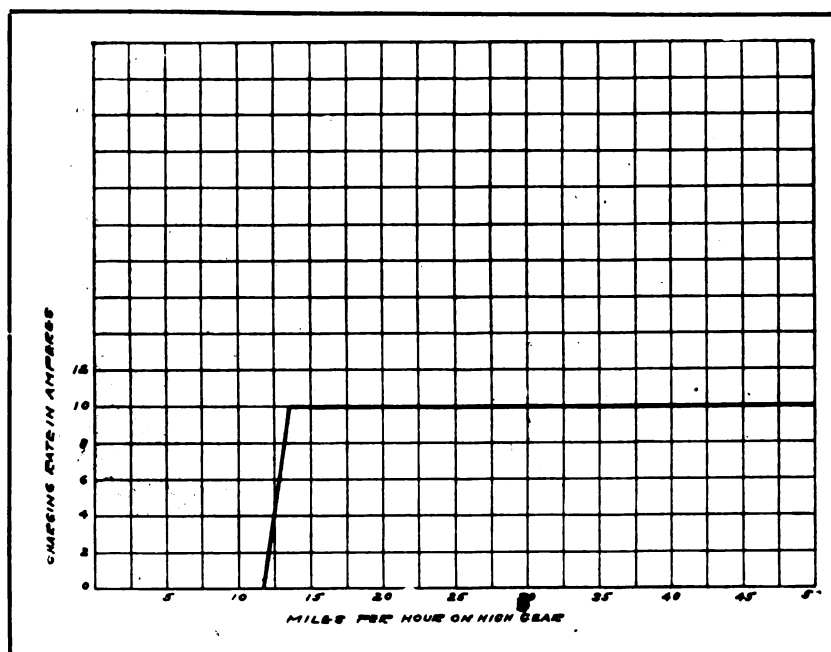
A Grounded or One-Wire System.

Examination of the wiring diagrams will show that the system is one wire—that is, one side is grounded. The battery connection is automatically controlled by the starting switch, which may be either foot or hand operated. The operation of the wiring circuits are shown. One will note that when charging the current flows in one direction, and when driving the motor will flow in the opposite direction, the directions being indicated by the arrows.

The manner of driving the generator has been stated, but the efficiency of the machine depends upon the tension of the belt. Through belt ten-

sion and regulation the production can be varied from eight to 15 amperes, although normally 10 amperes is regarded as sufficient for all ordinary requirements. The current output can be determined by the ammeter. When used in the country less current will be needed. The belt can be regulated as to tension by a slotted segment and set bolt on the fan support, so that the belt pressure can be varied considerably, a tight belt increasing the charging rate.

The flywheel coupling is made by pinion sliding on a jackshaft that simultaneously meshes with the pinion of the armature shaft and the external ring gear cut into or mounted on the flywheel. The arrangement is such that if the teeth of the sliding pinion butt against the armature shaft pinion or the flywheel gear, increasing pressure of the spring drives it instantly and completely into mesh when electrical contact is made.



Charging Characteristic of the System Shown by a Curve Indicating the Quick Rise to Maximum Charging and the Uniformity of the Charge at All Higher Vehicle Speeds.

With perfect engagement electrical contact is not made until the shifter fork carrying the sliding pinion has reached the end of its throw.

(To Be Continued.)

TWO ROUTES FOR DIXIE HIGHWAY.

After an examination of the route, Dixie highway officials have decided on two alternate roads north of Jacksonville, one going through Savannah and one through Waycross. The advantage of one route is that it is short and direct, while the other is longer and passes through a country of finer scenery. Both must be greatly improved in the next 12 months to retain the official designation. On the long road a bridge must be built and 70 miles of surface much improved, while on the other, in addition to road improvement, two bridges must be built.

BURMAN LOSES LIFE AT CORONA.

Two Others Killed and 15 Injured in the Accident—Car Makers Incorporate to Manufacture Gasoline.

Bob Burman was fatally injured, his mechanic and a policeman were killed and 15 spectators were hurt when a tire on his car burst during the Corona road race Saturday, April 8, causing the car to skid on a culvert and overturn. Burman was not killed instantly, but his ribs and legs were broken and his skull fractured, so that death followed in a few hours.

The accident occurred near the end of the race when Burman, because of bad luck with tires, was within four cars of last and was making a desperate effort to finish among the prize winners. Eddie O'Donnell, in a Deussenberg, won the Grand Prize, making the 301-mile course at a speed of 86.5 miles per hour, which is very fast for a road race. Joe Thomas was second, with a speed of 83 miles an hour.

News of the accident, which occurred just as O'Donnell was entering his last lap, was kept from the 80,000 spectators. This will probably be Corona's last race, as the townspeople who put up the money for prizes were deeply shocked by the accident.

Burman, for 10 years, has been one of the leading American race drivers. He held five records for straight away driving. They were one kilometer, 15.88 seconds; one mile, 25.40; two miles, 51.28. These were made in the Blitzen Benz at Daytona, Fla. In a Buick at Jacksonville he established a 20-mile record of 13:11.92 and a 50-mile mark of 25:52.31. He had the quarter-mile speedway record, made at Indianapolis in the Benz, of 8.16, and the one kilometer made at the same place in 21.40. He had six recognized dirt track records: One mile, 45.73; 15 miles, 12.47; 20 miles, 17:11; 25 miles, 21.38; 50 miles, 50.58, and 75 miles, 1:08.56.

MAKERS FORM OIL COMPANY.

Members of the Automobile Chamber of Commerce whose businesses have been threatened by the rise in the price of gasoline, have conducted a thorough investigation into the oil business to determine whether or not the present high prices are the results of manipulation and to find the most successful means that can be adopted to hold them to a reasonably low level.

They called into consultation men who have been active in the oil business and who know it thoroughly. The plan decided upon was to form a great oil company, stock in which should be owned by interests whose chief source of profit is the automobile business, and to operate the company in such a way that gasoline buyers can always secure gasoline at a proper price, allowing for only a reasonable amount of profit.

This company has already been incorporated at Albany for \$25,000, but ulti-

mately its capital will be from \$5,000,000 to \$10,000,000. Stock will be sold to motor car owners, dealers and makers, but will be so safeguarded that control of the company cannot pass out of the hands of automobile interests.

Access to the records of this company will keep the motor car makers constantly informed as to the proper price for gasoline and this, of course, could be transmitted to the public and the legislatures when public action should be necessary to prevent manipulation.

At the present rate of gasoline consumption an increase of one cent a gallon in the retail price costs the public \$17,000,000 a year. A company which



Bob Burman, Who Was Killed in Corona Road Race.

would succeed in reducing the price a few cents would effect an enormous saving for gasoline users.

SEE NEW ENGLAND FIRST.

The advantages of sojourning in New England during the vacation periods will be brought forcibly and persistently to the attention of Americans, particularly motorists, if the plans of the members of the Massachusetts and the Cape Cod, Marthas Vineyard and Nantucket hotel associations are carried out.

At the annual meeting of the Massachusetts association, President Arthur L. Race spoke of the efforts being made to boom New England and urged members to advertise the section, not only in the United States, but in foreign countries as well. He expressed the belief that the European war furnishes a strategic opening for furthering the interests of New England as a tourists' resort, and that the section has scenic beauties that are unsurpassed anywhere in the world.

Herbert M. Chase, president of the Cape Cod association, urged hotel men to advertise in groups in periodicals and to double the amount of money now spent for that purpose.

WINTON'S REPAIR CONTEST.

The ninth annual repair expense contest for chauffeurs of Winton Six cars has been announced by the Winton Company, Cleveland, and entry blanks are now being distributed. Cash prizes of \$3500 will be paid to employee drivers of Winton cars for the best records between May 1 and Oct. 31. The largest single amount is \$500. No entrance fee is required.

In eight years the contestants for these prizes have driven approximately 2,000,000 miles at a repair expense of 19¼ cents per 1000 miles. Many chauffeurs have won prizes in different years. The most frequent and largest winner is John L. Dondero, Brookline, Mass., who has received \$2200 from the Winton company in prizes.

HYATT BOOKLET ISSUED.

Results of the recent contest conducted by the Hyatt Roller Bearing Company to discover the cars equipped with its bearings which have made the greatest number of miles without replacement, have been published in a neat booklet which bears the title "The Final Proof." The book contains several photographs of F. E. Slason's "Old White Buick," which has made 261,800 miles, and of the other cars which were awarded prizes.

SUNBEAM CAR TO RACE HERE.

In spite of its preoccupation with war work and the turning out of a large number of aeroplane motors, the British Sunbeam company has built during the last year two six-cylinder, 24-valve racing cars, utilizing much of the experience it has gained in aeroplane work. These cars are said to have shown a speed of 120 miles an hour in trial runs on the Brooklands track. It is reported that Joseph Christiaens will be sent with the car and will handle it in some of the leading races on the American tracks this season. He is a Belgian and once won sixth place in the Indianapolis race. The car is said to have been designed with a view to conditions on American tracks.

The Fiat cars used in the Grand Prix of 1914 have been rebuilt in the factory at Turin. They have four valves and greater cylinder bores, but it is not known whether it is the intention to use those cars in the American races or not.

LAWSON ADOPTS SPLITDORF.

The Splitdorf Electrical Company, Newark, N. J., has closed another contract for supplying its ignition equipment. The Lawson Manufacturing Company, builder of the Lawson one-ton truck, has selected the Dixie-40 magneto and Splitdorf Common Sense spark plugs for its ignition requirements.

Position of Motor Stocks Shows Healthy Condition of the Industry.

Summary of Position of 10 Motor Securities, Which Shows Great Financial Strength.

Investors and brokers in Wall street have been turning their attention more and more to the activities of the 10 motor vehicle company stocks listed on exchange. These companies have an aggregate capitalization of \$209,237,339, and are furnishing the market followers with much that may be likened to sensationalism.

With the 1916 production season far advanced, it is safe to estimate that these 10 companies will produce about 650,000 of the 1,400,000 cars that are expected to be placed on the market during the year, and as a consequence will make a considerably larger profit for dividends than in the preceding period.

The following estimates of 1916 earnings are based upon operations in current months and are compared with the actual earnings on common stocks in 1915:

	1916 Net earn's (estimated)	% on com.	1915 earn.
General Motors	\$22,000,000	130	81%
Overland	17,500,000	75	50%
Studebaker	8,500,000	26	29%
Maxwell	5,000,000	27	6%
Chandler	1,750,000	25	14%
Chevrolet	8,000,000	40	*8%
Saxon	1,250,000	21	13%
White	1,250,000	21	13%
Hupp	800,000	14	8%
Chalmers	1,600,000	30	20%

*For 4½ months ended Dec. 31.

The strength of the motor vehicle industry as a whole was shown in the inauguration of dividends by many of the companies and by the extras and increased payments by others. A notable feature of motor stocks is that they sell on their earning powers and possibilities of future growth, rather than on dividend yield. Generally considered, automobile companies are conservative in the matter of dividend disbursements, which indicates a healthy condition of the industry.

The dividend rates and yields at present prices of these 10 companies is shown in the following summary of the position of their securities:

	Amount	Div. rate	Quota- tion	Yield
Gen. Mot. pfd.	\$14,985,200	7%	113	6.2%
Do common	16,506,783	20%	450	4.4%
Willys-Overl'd	21,000,000	*6%	229	2.6%
Do pfd.	15,000,000	7%	105	6.7%
Studebaker	30,000,000	10%	142	7.0%
Do pfd.	10,965,000	7%	110	6.4%
Maxwell	12,778,057	..	68	..
Do 1st pfd.	12,279,332	7%	85	8.3%
Do 2d pfd.	10,127,487	..	51	..
Chandler	7,000,000	6%	94	6.4%
Chevrolet	23,909,000	..	165	..
Saxon	6,000,000	..	67	..
*White	16,000,000	7%	51	7.0%
*Hupp	5,000,000	..	7	..
Do pfd.	1,500,000	7%	102	6.9%
Chalmers	5,000,000	10%	162	6.2%
Do pfd.	1,186,500	7%	98	7.1%

*Paid 5% stock dividend in 1915. †Par \$50. ‡Par \$10.

Notwithstanding the increase of prices of raw materials and the congestion of freight, etc., the motor vehicle industry is showing shipments that are about double in volume of those a year ago.

WHITE DIRECTORS ELECTED.

At the annual meeting of stockholders of the White Motor Company, which was held at the company's Cleveland office April 8, the following were elected to the board of directors: Windsor T. White, Walter C. White, A. R. Warner, E. W. Hulet, Otto Miller, M. B. Johnson, J. R. Nutt, J. H. Harding, A. M. Hall, 2nd., Theodore Roosevelt, Jr., and E. R. Tinker.

It is understood that the following will be elected as officers of the White Motor Company at the first meeting of the directors: W. T. White, president; W. C. White, first vice president; E. W. Hulet, second vice president; M. B. Johnson, chairman of the board; Otto Miller, treasurer, and A. R. Warner, secretary and assistant treasurer.

The White Motor Company has taken over all the assets of the White company, with the exception of \$500,000, and the capital of the latter reduced to a half million. The White Motor Company owns all the capital stock of the other White concern, which will be continued as the selling company.

BRISCOE SELLS ARGO PLANT.

The Briscoe Motor Corporation, Jackson, Mich., which formerly operated the Argo Motor Company of the same city, has disposed of that property to Mansell Hackett, former manager of the Disco Starter Company of Detroit. He will take immediate charge of the business with a new organization.

The plans for the Argo company are to continue the same models, for the time being, with the addition of a commercial car. Later a larger car to sell from \$600 to \$700 will be brought out on a schedule calling for production of 5000 the first year.

U. S. RUBBER OFFICERS.

The recently elected board of directors of the United States Rubber Company has chosen the following officers for the ensuing year: President, S. P. Colt, Bristol, R. I.; vice presidents, J. B. Ford and Lester Leland; vice president in charge of development work; R. B. Price; vice president in charge of mechanical department, E. S. Williams; assistant to president, J. N. Gunn; secretary, Samuel Norris; assistant secretary, J. D. Carberry; treasurer, W. G. Parsons; assistant treasurer, E. J. Hathorne.

The Chevrolet Motor Company has secured control of the entire production capacity of the National Cycle and Manufacturing Company, Bay City, Mich., for an indefinite period. The National company owns two large plants that cover about six acres of ground, thoroughly equipped to build motors and motor parts, and employs about 2000 men.

Capitalization of Midgley Tire Increased and Name of Company Changed.

Midgley Tire and Rubber Will Hereafter Be Known as the Lancaster Tire and Rubber Company.

The Midgley Tire and Rubber Company, Lancaster, O., has changed its name to the Lancaster Tire and Rubber Company. At the same time the capital stock was increased from \$550,000 to \$850,000. The increase is all seven per cent. cumulative preferred stock, and of the new issue \$100,000 has been taken by the present stockholders.

The new directors are F. A. Miller, Columbus, who is general manager of the H. C. Godman Shoe Company; H. B. Peters, Lancaster, president of the Fairfield National bank; C. S. Hutchinson, Lancaster, assistant secretary of the H. C. Godman Shoe Company and vice president Lancaster National bank; Harry Davis, Pittsburg, president of the Harry Davis Enterprises Company; E. E. Lerch, Columbus, secretary of the H. C. Godman Shoe Company; H. V. Blaxter, Pittsburg, of Lazler & Blaxter, attorneys-at-law; J. T. Rose, Lancaster, who is president of the tire company.

The operating organization, in addition to Mr. Rose, includes C. S. Hutchinson, vice president, and G. A. Stephenson, secretary and treasurer. Walter H. Hermann is factory manager and T. B. Davies is manager of sales.

R. C. H. TO MAKE PARTS.

Having discontinued the manufacture of cars, the R. C. H. Corporation will devote itself in the future to turning out replacement parts for R. C. H. cars that have already been made. Quarters have been secured at 31-33 Woodbridge street, Detroit, and all the equipment and material will be moved there. The personnel of the management remains the same. Charles P. Seider, president and general manager, and T. F. Drews, assistant general manager.

STEEL PLANT IN HARTFORD.

Peter A. Frasse & Co., Inc., will shortly erect a factory in Hartford, Conn., having purchased a site 320 feet facing on the Connecticut river boulevard. The building will be of the saw tooth type, 320 by 100 feet. It will be used for rolling and heat treating alloy steels.

SELDEN ASSISTS BOOTH.

Clarence H. Booth, president and general manager of the Scripps-Booth Company, Detroit, Mich., has selected C. G. Selden, formerly superintendent of one of the Studebaker plants, as assistant general manager. Mr. Selden has had wide experience in automobile factory management and has held executive positions in the technical, traffic and service departments of the business.

President of New Liberty Car Company, a Pioneer in Auto Industry.

Percy Owen, Selling Cars 17 Years Ago, Has Had Exceptionally Wide Experience.



C. G. Selden, Assistant General Manager of Scripps-Booth Company.

This addition is significant of the development of the company since Mr. Booth has become president. Having had a broad and successful career as an executive in the automobile industry himself, Mr. Booth has gathered around him an able corps of lieutenants. R. H. Spear is in charge of the sales department and is largely responsible for the increases that have been noted of late. Wm. B. Stout is credited with giving to Scripps-Booth advertising the quality that has made it distinctive, while the quality of mechanism in the car has been placed in the hands of C. A. Erickson, who was promoted from chief draftsman to chief engineer of the company.

The capital of the company was recently increased from \$250,000 to \$1,000,000, and to take care of the increased demand a new factory that will treble production is now well under way.

SACKS LEAVES GRAY & DAVIS.

After three years of service as advertising manager of Gray & Davis, Inc., Boston, Mass., Clarence O. Sacks has resigned to go with the Bates Advertising Company, New York City, as sales manager. He will handle the Gray & Davis advertising for the company. Mr. Sacks was formerly president of the Rowland Advertising Agency of New York. He is succeeded in the Gray & Davis company by E. W. Wackwitz, his former assistant.

MCANULTY LEAVES MITCHELL.

James P. McAnulty, who for the four years past has been sales engineer of the Mitchell-Lewis Motor Company, Racine, Wis., has resigned to take a few months rest before taking up new duties with another concern. Mr. McAnulty is a widely known authority on automobile construction, design and distribution, and in the past has frequently lectured at the automobile shows, universities, schools and conventions.

The new Liberty car, which is to be produced by the recently organized Liberty Motor Car Company, Detroit, is to be made by men who are thoroughly versed in the art of building motor vehicles. This is evident when one considers the long and varied experience had by the company's organizer, president and general manager, Percy Owen.

President Owen was selling motor cars 17 years ago. He opened the first gasoline automobile sales room on Broadway, New York City, and for seven years was eastern sales manager for the Winton Motor Car Company. Next he became exclusive American agent for the Italian Bianchi car. In 1908 he was appointed vice president and general manager of Page & Co., Chalmers agent, and under his guidance this company became New York's leading retail and wholesale agency.

Two years later he was Chalmers' eastern sales manager, and in 1913 was general sales manager. In 1915 he became vice president and a director of the Saxon Motor Car Company, of which he was one of the original organizers. Last January he severed active connection with Saxon, though retaining the directorship, and organized the Liberty Motor Car Company, of which he is president and general manager.

Mr. Owen's other activities include the presidency of the New York Automobile Trade Association for four years, he having organized it in 1902; as director of the Importers' Automobile Salon, and as one of the original directors and as treasurer of the National Association of Automobile Manufacturers, out of which has come the National Automobile Chamber of Commerce. He was also a charter member of the Automobile Club of America. Old time motorists will remember him as a racing driver in the early days of the sport and as a very influential power in race matters and associations.

Around him President Owen has gathered an exceptionally strong organization, which includes such men as James F. Bourquin, H. M. Wirth and R. E. Cole.

RUBBER GOODS EARNS \$2,037,744.

For the year ended Dec. 31, 1915, the Rubber Goods Manufacturing Company, New York City, showed net earnings of \$2,037,744 as compared with \$2,084,626 in the preceding year. Net profits of \$1,330,166 compare with \$2,193,220 in 1914.

The company in its statement accompanying the report attributed the falling off of earnings to adverse conditions in the tire department, they being felt throughout the entire heavy buying season. A marked improvement has been evident in the department since September.

PREMIER ACQUIRES TRACY.

The Premier Motor Corporation announces the acquisition of P. W. Tracy to take charge of the purchases and stores of the company. Mr. Tracy brings to the organization a wide experience in this country and Europe in the art of buying motor materials and installing machinery. A graduate of the University of Wisconsin and a practical engineer, he has been with the Buick, Winton, Pierce-Arrow, Chalmers and Paige-Detroit companies in responsible positions. As European representative for the Gisholt Machine Company, he spent two years in France and Belgium, during which time he directed the installation of equipment in the automobile plants of the Renault, Peugeot, Clement-Bayard, Berliot and other leading concerns.

AMBU SECURES PROF. MORTON.

The American Bureau of Engineering, Chicago, manufacturer of the Ambu electric trouble shooter, a device for detecting and locating trouble in the electrical systems of gasoline automobiles, announces that it has secured the services of Professor Morton, formerly of Armour Institute, as a member of its engineering staff.

WALSH GOES TO BRISCOE.

The Briscoe Motor Corporation, Jackson, Mich., announces the appointment of Robert T. Walsh as head of its advertising department. Mr. Walsh recently occupied a similar position with the Maxwell company at Detroit, and at one time was assistant advertising manager of the Ford Motor Company. He has been engaged in advertising for the past 11 years and is familiar with all the phases of the profession. This appointment is in line with Benjamin Briscoe's policy of building up an organization of specialists at the head of the various departments of the company of which he is president.



Robert T. Walsh, Advertising Manager of the Briscoe Motor Corporation.

Maxwell Motor Is Expected to Earn 30% on Its Common Stock.

Financial Experts Estimate a Production of About 80,000 Cars This Fiscal Year Ending July 31.

Basing estimates on a production of 80,000 cars during the fiscal year ending July 31, 1916, financial authorities are looking forward to earnings of about 30 per cent. for the Maxwell Motor Company on its \$12,778,000 common stock. For the last fiscal year the rate was six per cent.

Maxwell is one of the most talked of stocks on the market, and one of the statements being circulated is that dividends at the full rate of six per cent. on the \$10,127,467 second preferred may soon be inaugurated, possibly following the close of the 1916 fiscal year.

Deliveries of Maxwell cars during the past three months ought to have approximated 5000 a month, but owing to the freight situation, which has effected all car manufacturers alike, the output has been nearer 1300 during February and January. During March this rate was increased to about 7000, and it was expected that Maxwell plants would be putting out about 10,000 a month at the beginning of April and 12,000 in May.

KENT GOES TO EL PASO.

C. F. Kent, branch manager at the Pennsylvania Rubber Company's Dallas office in Texas, has resigned to join the Rio Grande Oil Company, El Paso, as secretary and treasurer, he having bought a fourth interest in the company. In connection with the oil business, the Rio Grande company will also have the agency for Pennsylvania tires in that section.

J. G. Smith, who has been in the Pennsylvania selling organization at Atlanta, Ga., succeeds Mr. Kent at Dallas.

NEW CAR FROM WISCONSIN.

L. P. Timmer, Schleisengerville, Wis., is president of the Time Manufacturing Company, which was recently organized to manufacture the Time car. The company is capitalized at \$150,000, and the factory is at Oostburg, Wis. The car is a six-cylinder, five-passenger model, selling for \$795. F. A. Tuschen is vice president and A. A. Grau, secretary. Mark A. Giblin, Cheboygan, Wis., is interested in the sale of stock in the new corporation. The first car will be shown soon.

A KEROSENE BURNING MOTOR.

The Field Motor Company, Grand Rapids, Mich., was organized recently with capitalization of \$100,000 to manufacture a kerosene burning motor which is said to be different from any other type now on the market. The company's plant is located on Grandville avenue, S. W.

The motor is of the horizontal type,

directly opposed. Above the cylinders are two carburetors of standard type and between them is a three-way valve. The charge of kerosene flows by gravity down to the manifold, which accommodates the exhaust, the heat units of the latter preheating the charge before it enters the cylinders. Only one manifold is used for four or more cylinders.

Gasoline is used to start the motor, after which the kerosene is switched on and the spark is slightly advanced. Regarding the surfaces and the regulation of the valves the company states that those matters are trade secrets.

CHALMERS TO AID DEALERS.

C. A. Pfeffer, vice president and assistant general manager of the Chalmers Motor Company, Detroit, announces the formation of a "Better Business" department, which will offer aid to Chalmers dealers in maintaining their businesses on a paying basis.

Mr. Pfeffer said that the department is an effort to incorporate the same business principles in the automobile industry that have brought successful results in other lines. He relates that statistics show a large percentage of failures among automobile dealers to be due to poor management, caused by incomplete and inaccurate records, and consequently one of the first aids sent out by the department will be in the form of a greatly improved system of accounting, which will enable Chalmers dealers to locate "leaks" in their businesses and to cut down expenses.

The system is intended for establishments handling upwards of 100 cars annually, but can be modified to meet the needs of a dealer doing a smaller business. A corps of experts will visit the various dealers and aid in the installation of the new system when it is necessary.

D. P. Turnbull, recognized as an expert in accounting systems, is at the head of the department, and he will suggest and help execute plans for increasing sales, improving service, sales rooms, correspondence, advertising, accounting, organization and auditing accounts. It is estimated that more than 1000 Chalmers dealers will benefit by the campaign for better business.

RAZOR MAKER TO BUILD AUTOS.

It has been reported in Indiana that interests connected with the manufacture of Gillette safety razors are to embark in the manufacture of motor vehicles at South Bend, Ind. The report said that the Amplex Motor Car Company plant had been transferred to the Gillette company, and rumor had it that the factory would be occupied about April 1 by a force of nearly 500 men. The statement has not been confirmed.

TRUCK COMPANY FORMED.

The Thomas Auto Truck Company has been incorporated in New York state and has opened offices at 220 West 40th street, New York City. C. K. Thomas is president. A factory will be secured in the city.

General Motors Shows Increase of \$41,300,000 in Gross Business.

Total Receipts from All Sources on March 15 Were Reported as Being \$87,800,000.

For 7½ months of its fiscal year, the period from Aug. 1, 1915, to March 15, 1916, the General Motors Company showed gross receipts from all sources of \$87,800,000 as compared with \$46,500,000 for the corresponding period of the year before. This indicates a gain of \$41,300,000, or an increase in gross business of 88.8 per cent.

On this basis and assuming that there will be no further increase, the gross income at the end of the fiscal year, July 31, would exceed \$135,000,000. On the other hand, if the ratio of increase is maintained the amount would be phenomenal, especially in view of the fact that this company five years ago was doing about \$42,000,000 of gross business.

It has been stated on semi-official authority that the net earnings of General Motors this year would reach about \$24,000,000, or more than 150 per cent. on the common. The company's stock is one of the sensations of the market, its earnings approximating closely to those of the common stock of the Bethlehem Steel Corporation.

STEARNS ADVANCES PRICES.

An advance of \$50 in the price of all models, effective March 20, has been announced by the F. B. Stearns Company, makers of the Stearns-Knight car. The rapid and continuous advance in the price of all materials is given by Frank B. Stearns as the reason.

Stearns production since the beginning of the year has already passed the mark set by the entire production of last year. This increase was made the basis of the lowered prices at the beginning of the year, but the increase in the cost of materials has more than made up the difference.

CHEVROLET STOCK AT 170.

Since last October the price of Chevrolet motor stock has doubled, from 85 to 170, on April 1. The rise is noted in financial circles as the most rapid of any of the securities offered in recent years.

The increase in production and earnings are amazing in similar degree. During the 12 months ended Aug. 30, 1915, Chevrolet production was 10,000 cars; for 1916 the company is planning upon an output of 95,000, which is 20,000 more than was announced recently.

In the matter of earnings the company showed a rate of 25 per cent. per annum for the four months ended Dec. 31 last. Interests close to the management predict that the rate for 1916 will be nearer 40 per cent., or a total of \$8,000,000, which is \$2,000,000 more than last reported.

THE GUARANTY PAYMENT PLAN.

Full Particulars of Plan for Purchasing Motor Vehicles on Deferred Payment Basis Are Announced.

The Guaranty Plan for the sale of motor cars on the deferred payment basis has been announced in all its details by the Guaranty Securities Corporation, New York City, its sponsor. As explained in the March 25 issue of *The Automobile Journal*, this plan is designed to be all inclusive and to overcome features in some other plans that were considered objectionable.

The chief purpose of the Guaranty Plan, which is the official designation given by the sponsors, is to facilitate the sale and purchase of motor cars by affording liberal credit terms for both dealer and purchaser. It is the means of removing a large share of the burden from the shoulders of the distributor, allowing him to do business on a large scale without tying up a large amount of cash. From the standpoint of the purchaser it allows one to obtain a car on a small cash payment and to have the use of it while paying the balance.

The cars listed by the Guaranty Securities Corporation under its plan are the Overland, Ford, Chevrolet, Dodge, Chalmers, Maxwell, Paige, Chandler, Studebaker, Reo, Oakland, Buick, KisselKar, Willys-Knight, Franklin, Hudson, Cadillac, Oldsmobile, Hupmobile, Jeffery and Mitchell. The initial payment is graduated, according to the price of the car, as follows:

Price of Car	Cash Payment Required
\$750 or less.....	33 1/3% of list
\$751 or \$1250.....	40% of list
\$1251 or \$1500.....	45% of list
\$1501 or more.....	50% of list

In addition to the initial amount to be paid, the purchaser is also required to pay, in cash, 2½ per cent. of the list price to cover necessary insurance and incidental expenses if the car lists at \$600 or more, and three per cent. if under that amount. The insurance is for full 80 per cent. fire and theft coverage for one year and is taken out by the Guaranty company, the certificate being mailed direct to the purchaser.

After these initial payments have been made—of course the purchaser must satisfy the dealer that his credit is good—the customer is required to sign a contract note which specifies that the balance is to be paid in at least eight equal monthly payments; these deferred payments bear interest at the rate of six per cent. The buyer can then take the car home, and use it while paying the balance due.

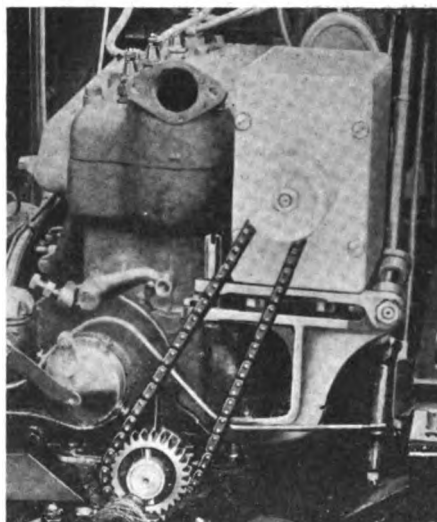
The dealer is required to indorse the contract note and send it to the Guaranty Securities Corporation, to which institution the monthly payments are sent by the purchaser direct. The dealer keeps the cash paid in at the initial transaction, and receives in cash 80 per cent. of the full value of the contract note from the Guaranty company, the remaining 20 per

cent. being held until the final payment is made. In lieu of this 20 per cent. in cash the dealer is given a deferred certificate, which in many cases can be realized upon to a large extent at the dealer's bank.

Dealers selling cars on the Guaranty deferred payment plan will be identified to the general public by having the corporation's large, full color emblem prominently displayed in his window. The emblem is a shield surmounted by an automobile, front view, and having the legend, "Guaranty Plan. Automobile Time Payments."

SPLITDORF ADVANCES PRICE.

The Splitdorf Electrical Company, Newark, N. J., announces that because of



Splitdorf-Apelco Starting and Lighting System Installed on Ford Car, Showing New Adjustable Hinged Bracket Feature.

the higher cost of materials it has been obliged to advance the price of the Splitdorf-Apelco electric starting and lighting system for Ford cars to \$75, which is an increase of \$10. While the price is now higher, it is noteworthy that the systems are now supplied with a notable improvement, an adjustable bracket feature, which makes it possible to easily take care of any play in the chain drive.

As seen in the accompanying illustration, this bracket is in two sections, hinged together, the lower part forming the base proper, while the upper forms the means of adjustment. The instrument is carried on the upper section and it can be raised or lowered and locked in position by means of a pair of set screws to obtain the proper chain tension. The tension of the fan belt is maintained, as in the standard Ford car, by an adjustable bracket on which the fan shaft is carried.

The bracket is easily attached to the forward end of the crank case on the left side by two special bolts which replace the regular ones. Connection is through silent chain to a gear that is attached to the front end of the crankshaft in place of the usual fan belt pulley. The fan is driven by a short belt running from a pulley on the front of the generator armature shaft.

Other attractive features in the refined, higher priced Splitdorf-Apelco system are the battery and a well finished box to be mounted on the running board, the starting and lighting switch, the indicator to show whether the battery is being charged or discharged, the driving gear and chains, and other fittings.

HORSELESS AGE IS VISIONARY.

The Iowa horse breeders deny emphatically the reports that have been published in the East to the effect that there is no demand for draught horses because of the increase in motor trucks. On the contrary they claim that horses are bringing the highest prices that have ever been paid. Recent sales in Iowa and at Chicago established a price of \$225 a head for draught horses of ordinary weight, while the very heavy ones brought \$250. No one living, they declare, will ever see a horseless age.

COMING EVENTS IN MOTORDOM.

April.

April 24-29—Show, Bangor, Me.
May.

May 6—Race, Sioux City, Ia.; speedway.
May 13—Race, New York City; Sheephead Bay speedway.

May 20—Race, amateurs, Chicago, speedway.

May 26-27—Convention, three Pacific Coast auxiliaries of National Assn. of Automobile Jobbers, Del Monte, Cal.

May 30—Race, Tacoma, Wash., 100 mile speedway.

May 30—Race, Indianapolis; speedway.
May 31—Race, Minneapolis; speedway.

June.

June 10—Race, Chicago, Ill.; speedway.

June 28—Race, Des Moines, Ia.; speedway.

July.

July 2-6—Convention, World's Salesmanship Congress, Detroit, Mich.

July 4—Race, Tacoma, Wash., speedway.

July 4—Race, Sioux City, Ia., speedway.

July 4—Race, Minneapolis, Minn.; 300-mile speedway.

July 4—Race, Coeur D'Alene, Idaho.

July 15—Race, Omaha, Neb.; speedway.

August.

Aug. 5—Race, Tacoma; speedway.

Aug. 18-19—Race, Elgin, Ill.; road.

September.

Sept. 4—Race, Indianapolis; speedway.

Sept. 4—Race, Des Moines; speedway.

Sept. 16—Race, Providence; speedway.

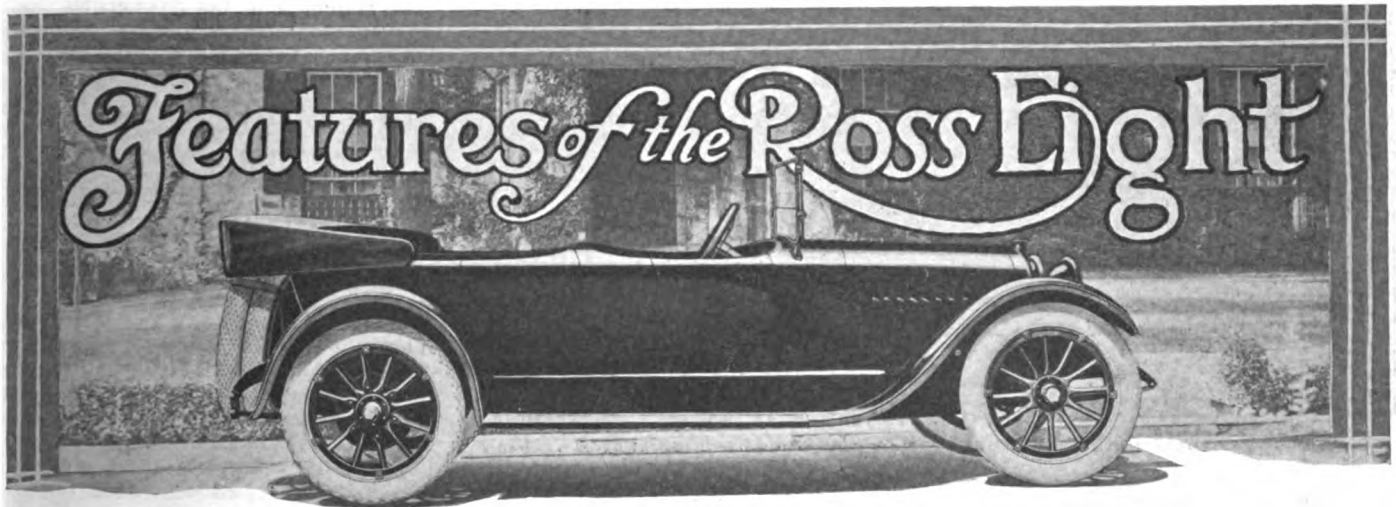
Sept. 30—Race, New York City; Sheephead Bay speedway.

October.

Oct. 7—Race, Omaha, Neb.; speedway.

Oct. 14—Race, Chicago, Ill.; speedway.

Oct. 19—Race, Indianapolis, Ind.; speedway.



WHEN the automobile industry was in its infancy a decade ago the motor vehicle manufacturers were not adequately equipped to keep up with the demand for cars and consequently contracted with machine shops to take over a portion of the work. One of these was the Ross & Young Machine Company, which had a large and well equipped shop in Detroit. For eight years this company continued to build cars for automobile makers, taking the full responsibility of the work, from specifications to the finished product.

Recently the Ross & Young officials decided to enter the industry on their own account, basing their assurance of success on the fact that their product had always been exceedingly satisfactory to the car makers with whom they had contracts. The Ross cars won an enviable position immediately, and the line has been improved steadily.

The latest Ross product, which is made by the same organization, but under the name of the Ross Automobile Company, Detroit, Mich., is the model C eight-cylinder, seven-passenger, 130-inch wheel-base car, which is priced at \$1350. It is an exceedingly attractive design, its pure stream lines giving a racy effect, though sturdiness and power are also evident.

The car is equipped with a 34-horsepower Ross-Herschell-Spillman eight-cylinder motor. The cylinders, which are $3\frac{1}{4}$ by five-inch, are cast en bloc and set at the conventional 90-degree angle and staggered to permit of the connecting rods being placed side by side, which allows for easy adjustment. The connecting rod bearings and three main bearings are of generous size to insure long

life and are finished by a special burnishing process which gives a perfect bearing surface.

When designing the crankshaft the engineers gave particular attention to providing an abundance of strength and rigidity. The valves being large and the pistons and connecting rods light and well balanced, the operator of this Ross eight can get away quickly at the start and have surplus power on hills. A distinctive feature of the power plant is its freedom from vibration at all speeds.

The cooling system is unusually am-

CHASSIS DETAILS OF THE NEW ROSS EIGHT MODEL.

Motor	.... Ross-Herschell-Spillman
Horsepower (S. A. E. rating)	.. 33.8
Shape and cast	..... V-En bloc
Cylinders	..... Eight
Bore and stroke	..... $3\frac{1}{4}$ by 5
Piston displacement	..... 331.8
Cooling system	..... Pump
Lubrication	..... Pressure
Ignition	..... Battery
Carburetor	..... Zenith, duplex
Starting, lighting	.... 2-unit system
Clutch	..... Dry plate
Gearset	..... Selective, three
Wheelbase	..... 130 inches
Wheels and tires	.. Wood, 34x4 inch
Rear springs	..... $\frac{1}{2}$ -elliptic
Steering and control	.. Left, centre
Rear Axle	..... Full floating
	Price.

Touring, seven passenger.... \$1350

ple. Water is circulated around the cylinders and valves through exceptionally large water jackets by a large centrifugal pump which keeps the water moving constantly. The radiator is of the zig-zag tube type and is used in conjunction with an 18-inch, six-blade positively driven fan.

The force feed system of lubrication is employed, a gear pump drawing the oil from the reservoir in the crank case and pumping it to the main bearings, connecting rod bearings and wrist pin bushings. Oil is thrown off by the shaft and rods to lubricate the rocker arms, tappets, camshaft and cylinder walls. The surplus drains back into the reservoir and after it is screened is used over again.

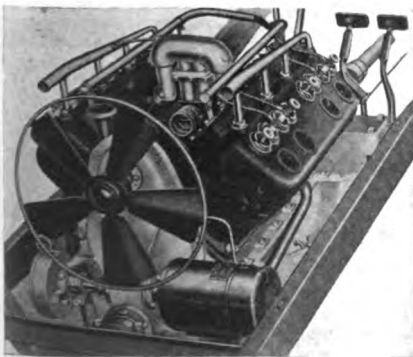
The pressure of the oil is controlled by an automatic regulator, the excess being delivered to the front gear compartment, where it is used to lubricate the gears which drive the camshaft, pump, generator and fan.

A Zenith duplex carburetor affords efficient carburetion. Part of the intake passage being in the exhaust manifolds and the intake manifold water jacketed insures plenty of heat for the gas. In addition, the air is also heated before entering the instrument, which is a practice that has been found very desirable.

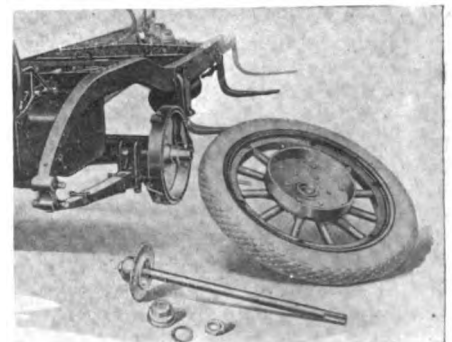
A notable feature of the motor design is that nothing but the carburetor is carried in the valve alley, which makes for ease in adjusting tappets. This simplicity of accessibility is carried out throughout the whole chassis and is a constructional detail that appeals to every motorist.

The battery system of ignition is employed, the current being supplied to the spark plugs by an Atwater Kent distributor, which is driven by the camshaft and is located at the rear of the left hand block of cylinders. A set of dry cells is supplied for emergency purposes.

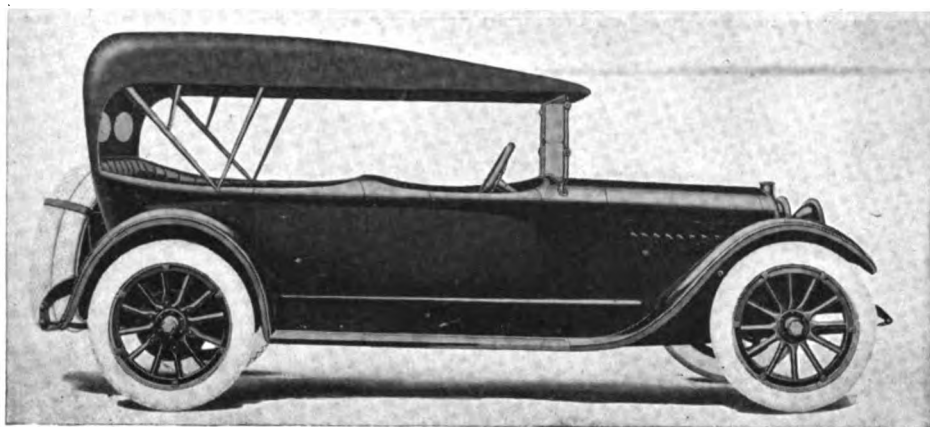
The starting and lighting system is of the double-unit type. The generator is mounted crosswise on the forward end of the crank case, while the starting motor is at the rear and has an outboard Bendix gear connecting it to the toothed fly-wheel. This gear accomplishes the same work as the overrunning clutch and is very efficient and not troublesome. The six-volt battery of the system is carried between the running board and the frame, as is shown in the views of the chassis. Access for inspection is had by



Power Plant of the Ross Eight, Showing the Clean Valve Alley.



Illustrating the Ease with Which Wheels Can Be Removed.



The Seven-Passenger Ross Eight Touring Model, Showing Its Racy Lines and Long Wheelbase.

removing a small section of the running board shield, which is held in position by two thumb screws. This arrangement leaves the boards clear and adds to the appearance of the car.

As regards the clutch, this is carried in unit with the transmission case at the end of the crank case, which is of aluminum and is flared at the rear to receive the unit. The clutch is of the dry plate type with steel and Raybestos as the frictional surfaces. It is provided with a large taper spring with ample adjustment to control its tension, while easy movement of the pedal is insured through there being compound leverage. Another feature is that the pedals can be adjusted to meet the requirements of operators. Additional adjustment to lessen or increase the amount of throw in the clutch is also provided.

The type of the transmission gearset is selective, unit with the motor, while there are three speeds forward and reverse. The bearings are of the ball type and the gears and shafts are of chrome nickel steel.

Power is conveyed to the rear axle by a propeller shaft enclosed in a tube, which extends forward and is linked to the rear of the transmission to take care of the torsional strain of the rear axle. A single well protected universal joint is placed between the propeller shaft and the gearset. When loaded the drive is practically in a straight line.

The rear axle is full floating, the sturdy housing carrying the load and the shafts being employed only in the duty of driving. The differential, as well as the wheels, is mounted on large sized Gurney ball bearings. In accordance with the latest accepted engineering practise, the bevel driving gears are helical with a standard gear ratio of 4.6:1.

Though the wheelbase is 130 inches, the frame is so braced and strongly constructed that there is no weaving.

To obtain the very highest degree of riding comfort the springs have been made long. Both front and rear sets are of the semi-elliptic type, those at the rear being 57 by 2½ inches and at the front 42 by two inches. The brakes are of the internal expanding and external contracting type, operating on large drums on the wheels.

The wheels are of the wood artillery design, provided with Detroit quick demountable rims on which are carried 34 by four-inch tires, non-skid at the rear. A tire rack at the rear of the car is so arranged that either one or two extras may be carried. Just forward of this rack is a gasoline tank of 18½ gallons capacity, which is provided with a gauge. Fuel feed is by the vacuum system.

The body is very attractive and comfortable. The cushions are broad and deep and well supplied with springs and the seat backs are high and well "sprung." When not in use the auxiliary seats fold forward into the back of the front seats, curtains being provided to conceal them.

The instrument board on the cowl carries speedometer, ammeter, electric light, ignition switches and oil pressure gauge. The large steering wheel is placed at the left, while the control members are in the centre. The steer-

ing system is of the irreversible type.

The top is in keeping with the rest of the car, being designed to blend with the body lines; it is made of Neverleak material and is of the one-man type. The car weighs 3100 pounds ready for shipment and is furnished as standard in a dark gray with gray wheels.

ASK DEALERS' AID FOR SAFETY.

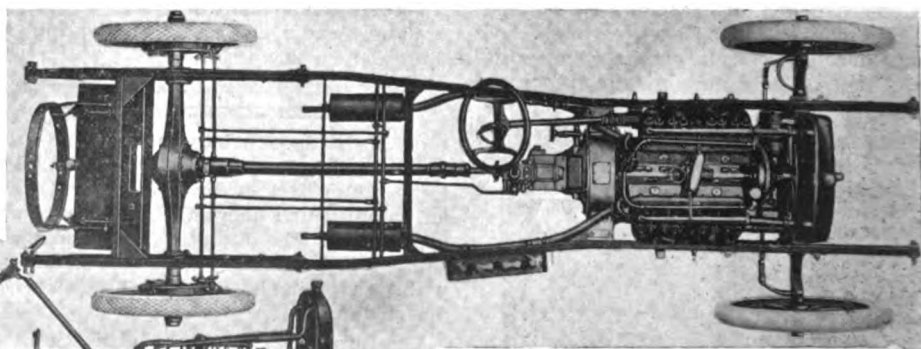
To devise ways and means of advancing the Safety First propaganda of the National Automobile Chamber of Commerce, a committee headed by J. Walter Drake, head of the Hupp Motor Car Corporation, had conference in Detroit recently with Frederick H. Elliott, secretary of the Safety First Federation of America; Charles M. Talbert, director of streets of St. Louis, and John Gillespie, commissioner of police of Detroit.

It was decided to begin a campaign to secure the influence of every automobile dealer who could be reached through those manufacturers who are members of the national automobile chambers. These men are influential in their communities, especially among motor car owners, and if every dealer in every town should use his influence to aid the city authorities in controlling motor traffic, decisive results would be achieved.

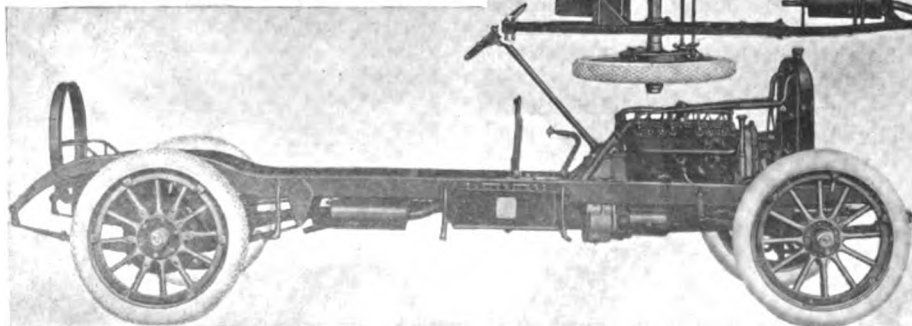
In nearly every large city committees are being formed to co-operate with the police in working out arrangements to increase the public safety so far as it is affected by the motor car. In greater Detroit there is a committee of 100 and sub-committees have been formed to reach the members of various Detroit civic associations. In Chicago, Charles M. Hayes, president of the Chicago Motor Club and the City Public Safety Commission, is carrying out similar plans.

EMPIRE FINISHED IN VIOLET.

One of the features of the Empire exhibits at this season's automobile shows was a six-cylinder, five-passenger model, finished in violet. During the Boston show it was sold to A. M. Wilson, a photographer in Brockton, Mass. The car is very striking.



Two Views of the Ross Eight Chassis, Which Is Braced Strongly and Though Has Long Wheelbase Does Not Weave—In This View Is Shown the Location of the Six-Volt Battery Between the Running Board and Frame, Which Is Reached Through a Small Trap Door in the Running Board Shield.





A CAR maker comparatively new to the market, but one which has succeeded in securing a large representation, especially throughout the East, and has attracted a great deal of public attention to its offering, is the Bell Motor Car Company of York, Penn.

This has been possible because the car is a trim, handsome design, in which are included most of the up-to-date details that have been thoroughly tried out and found to be efficient and popular. This model is sold, moreover, at a price that enables competition on even terms with even the older manufacturers in its field.

Among the noticeable features are a removable cylinder head, spiral bevel differential gears, helical timing gears, Hotchkiss drive, mud apron protecting the radiator and many advanced features connected with the accessories and equipment.

The car has been designed by an engineer of long experience in the industry, who has been chiefly occupied upon high-grade and higher priced cars, and has been able to produce an exceptionally roomy and luxurious appearing machine.

There is nothing exceptional about the Lycoming motor used except its combination of so many advanced, but fully accepted refinements. It has four cylinders, $3\frac{1}{4}$ by five inches, with L type head, and is cast en bloc. The head is detachable, gears are helically cut and are fully enclosed. The aluminum crank case is split through the centre and the power plant is suspended at three points. There is a water space between the cylinders. The manifold for exhaust gases is of the ejector type.

This motor is rated by the manufacturer at 30 horsepower. It has single-unit ignition and very light reciprocating

parts. Lubrication is accomplished by the constant level splash circulating system with a plunger pump operated by an eccentric on the camshaft. The oil cir-



CHASSIS FEATURES OF BELL CAR GRAPHICALLY TOLD.

Make of motor.....	Lycoming
Shape and cast.....	L-En bloc
Cylinders and size..	Four, $3\frac{1}{4}$ by 5
Horsepower	30
Piston displacement.....	192.4
Cooling system.....	Thermo-syphon
Lubrication	Splash
Ignition, make....	Single, At-Kent
Carburetor	Carter
Clutch	Cone
Starting and lighting.....	Disco
Gearset.....	Selective, three
Wheelbase	112
Wheels and tire size...	Wood, 31x4
Rear springs.....	$\frac{3}{4}$ -elliptic
Steering, control.....	Left, centre
Rear axle.....	Full floating
Price.	
Touring, five passengers.....	\$775
Roadster, two passengers.....	\$775



culating pipes are outside of the engine. The valves are $1\frac{1}{8}$ -inch diameter, with 45-degree seats, and the heads are cast

iron, electrically welded to high carbon steel stems. The free gas opening is $1\frac{1}{8}$ inches, with a mushroom type valve lifter which is hardened and ground.

The crankshaft is 40-50 carbon steel alloy, which is double heat treated and drop forged and balanced and ground on all bearings. The front crankshaft bearing is $3\frac{5}{16}$ by $1\frac{1}{4}$, and the rear bearing $4\frac{1}{16}$ by $1\frac{1}{4}$, while the connecting rod bearings are $2\frac{3}{4}$ by $1\frac{1}{4}$.

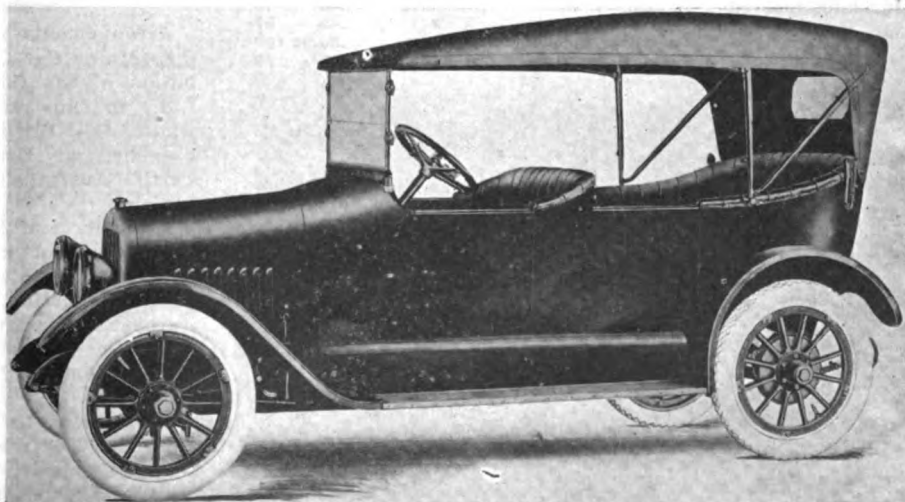
The camshaft is supported by three bearings; it is one inch in diameter, case hardened, and ground at the bearings and cams.

There are large water outlets in the thermo-syphon cooling system, with $2\frac{1}{2}$ -inch outside diameter. Rubber piping connects the engine with the radiator tank, which is very advantageously located for efficient cooling.

The carburetor is a Carter float feed type with a dash adjustment, and ignition is controlled by an Atwater-Kent unisparker equipped with a reversing switch. The lighting generator is a low inertia type driven by silent chain from the motor crankshaft. No moving parts are exposed. It is adjustable for chain tension and the brushes are easily accessible. A Willard 12-volt storage battery is standard equipment with a Ward-Leonard controller.

The clutch is a leather faced cone with a spring insert to make gradual engagement possible. Immediately behind it in unit with the engine is a transmission designed by the Bell company. It is carried in an aluminum case, and has three speeds forward and one reverse. The shafts are of nickel steel, as are the gears. Ball bearings are used on the shafts.

The full floating rear axle has an inspection plate at the rear, so that the gears may be examined. These are helically cut. Ball



The Bell Model 16, Touring Car, Which Has Capacity for Five Passengers, Sells for \$775 and Is Equipped with Starting and Lighting System.

bearings are used in the differential and roller bearings at the hubs.

Artillery type wheels are employed. They are made from second growth hickory and carry 31 by four-inch tires. Service brakes are internal contracting on drums of 12-inch diameter with two-inch face, and are controlled by the right foot pedal. The emergency brakes are internal expanding on the same drums and are controlled by hand lever.

The clincher rims are of the quick demountable type and an extra rim is furnished. It is carried in the tire rack at the rear of the body. Tires are 31 by four, with non-skid treads on the rear wheels.

Semi-elliptic springs are used in front and are 1¾ inches wide by 36 inches long; rear springs are three-quarter scroll type, two inches wide by 44 inches long.

The frame is a pressed steel channel section four inches deep. The upper half of the rear spring bracket is integral with the frame. Drive is taken through the springs by the Hotchkiss system. The shaft works at a two-degree angle under a full passenger load.

Wheelbase is 112 inches and tread 56 inches.

Sheet Steel Body.

The body is of sheet steel and its outline follows the most modern stream line development. The gasoline tank is carried in the cowl. The instrument board in the front compartment is inclined.

Ample room is provided for the passengers on the front seat, which is 46 inches wide and has divided cushions. The rear seat is 54 inches wide. There is 29 inches of leg room in the front compartment, while in the rear 28½ inches is provided. Front seats are 20 inches deep, the rear seat 22 inches. The upholstery is covered with genuine leather.

The one-man top of high-grade mohair is rigidly fastened to the windshield. This latter is of a rain vision ventilating design 39 inches wide, 18 inches high and filled with plate glass.

The capacity of the gasoline tank is 10 gallons and the car is declared to average 22 miles to the gallon. It weighs 2200 pounds.

The prices of the touring and the roadster models are the same, \$775 f. o. b. York, Penn.

How Prices of Raw Materials Have Been Advanced.

Comparison of Prices in 1914 and 1916
As Compiled by F. E. Watts,
Hupp's Chief Engineer.

To give dealers and prospects definite information regarding the extent of the increases in prices of materials entering into the manufacture of motor vehicles, Chief Engineer Watts of the Hupp Motor Corporation recently issued the following list as they stood July 31, 1914, and they were on March 6, 1916:

Material	July 31, 1914.	March 6, 1916.	In- crease P. C.
Pig iron, per ton.....	\$13.00	\$20.00	54
Curled hair, per lb.....	.18	.30	89
Twine.....	.12	.16	25
Celluloid, per sheet.....	.26.64	.36.85	38½
Imitation leather, per yard.....	.50	.58	16
Felt.....	Unchanged	Unchanged	
Fibre.....	Unchanged	Unchanged	
Real leather, per sq. ft.....	.26	.31	19
Cable, per 1000 ft.....	\$95.60	\$112.92	18
Tires, per set.....			39
Glass, per sq. ft.....	.23	.33	43
Rubber, per lb.....	.34¼	.36¾	7
Burlap, per yd.....	.06.95	.12	34
Cambric, per yd.....	.04¼	.05½	22
Upholstery cloth, per yard.....	1.80	2.00	13
2½" stay webbing, per piece.....	.87	1.15	32
Wood for body frames.....			7½
Wood for veneered toe boards.....			7½
Bar steel.....	.01.15	.02½	117
Sheet steel.....	.01.8	.02.6	44
Copper.....	.14.62½	.27¼	86
Spelter.....	.04.85	.19¼	297
Lead.....	.03.72	.06.6	77
Tin.....	.33	.48½	47
Aluminum.....	.17¼	.63	265
Seamless tubing (brass).....	.17½	.42	124
Seamless tubing (copper).....	.21¼	.44	100.5
Para rubber.....	.59	.88	49
Sheet brass.....	.16¾	.37	120
3¼ nickel steel.....	.03¾	.05¾	53
3¼ nickel steel (OH).....	.07½	.10	33
Crucible steel.....	.02	.03	50
C. S. M. steel.....	.06¾	.09	38
Mildvale, No. 11 steel.....	.06	.08½	43
Steel tubing.....	90% off of list		
Steel tubing.....	84% off of list		
Babbitt.....	.37½	.45	20
Brass castings.....	.20	.32	60
Semi-steel.....	.01.8	.01.96	8½
Cylinder iron.....	.03¾	.05	33
Bronze.....	.24	.45	87
Guthrie metal.....	.14.64	.30.62	109
Malleable iron.....	.04¼	.05½	29

Instead of decreases in the immediate future, Mr. Watts expects the present high prices to continue, if they do not go up still further. His reasons are: That the steel companies are selling their product for the present high prices till nearly the end of the year and to protect themselves are contracting for iron and other materials at present prices, which are equally high. Practically all the ferro manganese used in making steel comes from England and the last quotation for this material was \$225 per ton as compared to \$40 before the war. The British government has also declared an embargo on this material and it will be impossible to get any except from some other source. A company for this purpose has been formed in Chicago, but it will take some months before it begins operations.

The railroads are ordering heavily and foreign governments are large buyers of railroad materials.

PATHFINDER PRICES ADVANCED.

W. E. Stalnaker, vice president and director of sales of the Pathfinder Company, Indianapolis, has advised his dealers by letter that because of the greatly increased cost of materials and labor in its 12-cylinder cars, the company is obliged to advance the list prices.

Mr. Stalnaker wrote that "some of the concerns with whom we have contracted have been unable to fill their contracts at the agreed price, due to the fact that they were not thoroughly covered for raw material, prices of which have advanced so rapidly that in some instances the raw material cost our parts makers as much, or more, than the amount they had agreed to furnish us the finished article for, so that we have been obliged to accept advanced prices from them in order to get the material and this forces us to advance our prices or do business at a considerable loss."

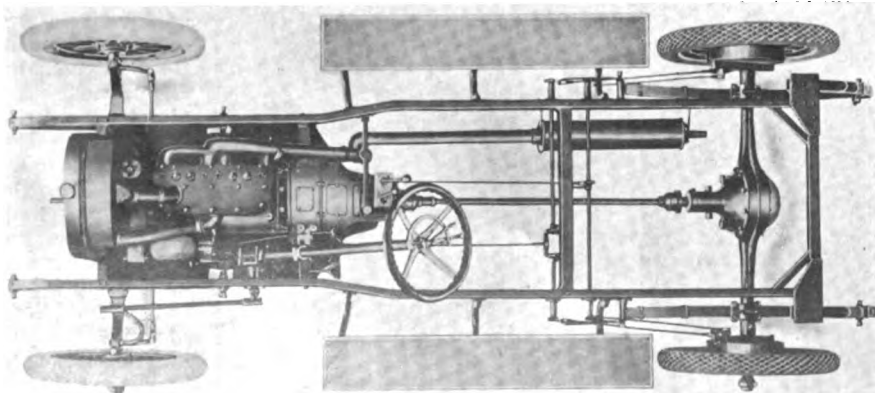
No change has been made in the price of the Pathfinder six-cylinder model. The new rates on the 12-cylinder cars, which go into effect April 15, are \$2750 for the 12-cylinder touring model and \$2900 for the 12-cylinder Cloverleaf roadster.

COLE EIGHT IN AUSTRALASIA.

Arrangements have been made by the Cole Motor Car Company for the distribution of the Cole Eight by Chipman, Ltd., in Australia and New Zealand, where the British company has sales branches at Sydney, Melbourne and Perth, Australia, and Wellington, New Zealand.

Australia and New Zealand are very prosperous notwithstanding that 500,000 of their men, which is nearly 10 per cent. of the population, are doing duty in the European war. Good seasons in wool production and general crops have created a demand for all commodities at fair prices.

Car prices to Australian buyers include a \$250 freight charge, a duty of \$85 on the body, in addition to a heavy duty on the chassis and its equipment. The first Cole shipment will go to Australia under the contract in a few days.



Stripped Chassis of the Bell Four-Cylinder Model, Showing the Sturdiness of the Frame and the Neat Power Plant.

ROAD BUILDING TO COST MORE.

Massachusetts Contractors Fear the Advanced Cost of Materials Will Effect Extent of Road Building.

Since last year there has been a great increase in the cost of labor and materials for road building and an even greater increase in the cost of oil and other materials for maintenance. For this reason Massachusetts road builders, who expect to begin their work on the roads as soon as the frost is out of the ground, figure that the money they have available will only be enough to pay for building from 15 to 20 per cent. less road in 1916 than it has previous years and that it will not be possible to keep the roads already constructed in such good condition as formerly.

Price of Material Higher.

The largest increase in the cost of road material is that of road oil, which has followed gasoline to a level nearly 100 per cent. higher than that of last year. This will mean that less road will be oiled than usual or that the usual mileage will be oiled less often.

There is also a marked shortage in the kind of labor that is usually employed by contractors on the roads. Men are asking an average of 10 per cent. more for their work than usual and the contractors must pay it and even then are likely to be short handed.

Concrete in High Favor.

Concrete road which has been growing in favor as compared with bituminous macadam, is also more expensive because of an increase of about 50 per cent. in the price of cement.

There is much concern over the condition the roads will be in this spring. They have been covered with snow and frozen up for several months. Ordinarily this would be favorable condition, as the snow and ice covering the surface protects it from traffic. But this year just before the snow came there was a heavy thaw, which soaked the roads and the water froze into them. This may have broken them up badly through expansion when the water congealed.

NEW JERSEY ROAD PROGRAMME.

There is much controversy in New Jersey over a highway bill which proposes to raise \$7,000,000 by bond issue to build eight hard surfaced highways to connect important points in the state. It is proposed that both principal and interest on these bonds shall be paid from the return for motor vehicle fees. Motorists object to this on the ground that it places the whole burden of highway improvement upon them.

The routes under discussion are from Elizabeth to Trenton by way of Rahway, Metuchen and New Brunswick; from Camden to Absecon by way of Berlin and Hammontown; from Trenton to Camden by way of Bordentown and Burlington; from Rahway to Absecon via

Perth Amboy, Mattewan, Freehold, Lakewood, Toms River, Tuckerton and New Gretna; from Newark to the Delaware bridge, two miles above Delaware, by Morristown, Chester, Hackettstown, Buttsville and Delaware; from Camden to Bridgeton via Woodbury and Mullica Hill; from Trenton to Asbury Park by White House, Imlaystown, Freehold, Jerseyville and Hamilton; from Montclair to Sussex by way of Signac, Wayne, Pompton Plains, Butler, New Foundland, Stockholm and Franklin Furnace.

The roads are to be made as short and direct as possible between the terminals and for that purpose a new right of way will have to be secured in some sections.

MOTORS INCREASE PARK COSTS.

Cost of maintaining the various parks under the control of the Massachusetts Metropolitan Park Commission has been increasing rapidly because of the growing use of motor cars and the new and more expensive standard of road construction. The amount required for maintenance and for interest on the debt of the commission is now \$1,500,000 a year. This amount is proportioned among the various cities in the Boston district and is raised by taxation.

MAINE FOR GOOD ROADS.

The Republican state convention held recently in Maine turned out to be a good roads meeting. The subject was discussed more than any other and it seemed practically certain that the party would obligate itself to some action continuing the programme of road improve-

ment which was begun with the expenditure by the state of \$2,000,000 raised by bonds.

There was some complaint that the roads already built were made exclusively for motor cars and that they were not well adapted for use by horses. New roads, it was insisted, should be of such a type that both horses and motors could make use of them effectively.

Paying for the roads by taxation was not approved, but rather a plan of issuing bonds with the intention of meeting both the interest and the sinking fund requirements out of the proceeds of automobile licenses. This will probably mean high license fees for Maine motorists if it is put through.

URGES FARMERS TO STUDY ROADS.

Farmers who wish to understand methods of properly draining roads and keeping them in good condition during the wet months of the spring are urged by the American Highway Association to drop a card to their respective state highway commissions and the United States Office of Public Roads at Washington.

A night's study on the material that is received will convince the farmer that the annual season of impassable roads is not at all necessary and can be avoided by inexpensive and intelligently directed work.

LINCOLN WAY STRAIGHTENED.

While it is not the policy of the Lincoln Highway Association to make many or unnecessary changes in the route of the Lincoln highway, an effort is being made everywhere to cut down the mileage by straightening it. Already 180 miles have been cut from the run from New York to San Francisco. It was originally 3484 miles, but this has been reduced to 3300 miles at present.



Illustrative of the World-Wide Popularity of Overland Cars is This View of One of That Make Standing Beside Ancient Hindu Idols on the Island of Bali, Near Sumatra, Dutch East Indies.

THERMAL EFFICIENCY OF AUTOMOBILE ENGINES.

C. E. Sargent, Chief Engineer of the Lyons-Atlas Company, Discusses the Subject in a Paper Read Before the Indiana Section of the Society of Automobile Engineers.

THE object of this paper is not to criticise the thermodynamic cycle of the automobile engine of today, but to point out its inherent inefficiency as operated, and to suggest a method of converting more of the heat of the fuel into useful work than is ordinarily done at the average, as well as through its whole range of load.

With the specific gravity and surface tension of motor fuels increasing, and the price 400 per cent. higher than in the horseless carriage days, one of the greatest present needs in the automobile industry is cheaper fuel, or more power from the same quantity of gasoline.

Heat Balance.

In order to properly comprehend the problem of increasing the thermal efficiency of internal combustion automobile engines

$$\frac{\text{heat converted into useful work}}{\text{Total heat supplied in fuel}}$$

we will refer to diagram Fig. 1, in which, of the 100 per cent. of heat supplied, 20 per cent. is converted into work and 80 per cent. lost or rejected in friction, cooling water radiation and exhaust.

To convert more heat into work it will be necessary to decrease one or more of the losses indicated, all of which are characteristic of internal combustion engines.

With good workmanship, force feed oiling and light reciprocating parts the mechanical efficiency

$$\frac{\text{B. H. P.}}{\text{I. H. P.}}$$

is about as high as can be expected, and we may look for no further appreciable gain from that source; as a matter of fact, but five per cent. of the total heat supplied seems a small amount for engine friction.

Water Jacket Losses.

The loss of heat to the water jacket depends on the difference in temperature between the burning gases and the cylinder walls, the time the cylinder walls are exposed to the heat of the flame and the surface exposed. If we could maintain the combustion chamber at the same temperature as the inclosed gases there would be no difference in temperature and no transmission of heat, consequently no loss to the walls and water jacket, but such a temperature would not only destroy all vestige of lubrication, but would melt the cylinder walls and pistons.

The time per working stroke in which the difference of temperature exists is cut down by high speed, wherein lies the advantage of high piston speed in an engine of this type.

The thermal efficiency of big guns lies in the missile speed—nearly 3000 feet per second—while the maximum piston

speed obtained in an engine cylinder probably never exceeds 40, and seldom averages over 20 feet in the same unit of time. One of the most economical internal combustion engines ever designed had a free piston, which, returning to the cylinder by gravity, converted more heat units into work than has any engine with a restricted piston.

While the ratio of the explosion chamber surface to the volume it contains is one efficiency factor, and the requirements of a minimum quotient the rational reason for valves in the head, the advantages of multi-cylinder engines with their high speed, light reciprocating parts and minimum angular velocity va-

a high piston speed, a minimum surface per unit of volume characteristic of the sleeve valve and the valve-in-the-head types, and as high a compression as possible without the possibility of spontaneous ignition.

Exhaust Losses.

While small gains in efficiency have been made by reducing the mechanical friction and decreasing the losses to the water jacket, the loss of heat to the exhaust has had but little consideration.

Several compound engines of the internal combustion type have had a mushroom existence, but when one considers the added surface of a larger cylinder and the time in which the pressure after ignition drops to less than the pressure of compression, we see the improbability of reducing the losses by this means.

The ordinary engine is more efficient at full load than at partial load, but unfortunately the automobile engine operates at partial load most of the time, therefore, if we would increase the B. H. P. per unit of fuel or the miles per gallon, it should be so designed that its thermal efficiency is greatest with average or partial loads, or at least is no less than with full load.

In order to thoroughly comprehend our problem let Fig. 2 represent an indicator diagram of an internal combustion engine developing its full power, in which AB represents the piston stroke and atmospheric line; C the highest compression; CD the firing line; DE the expansion line and E the exhaust opening.

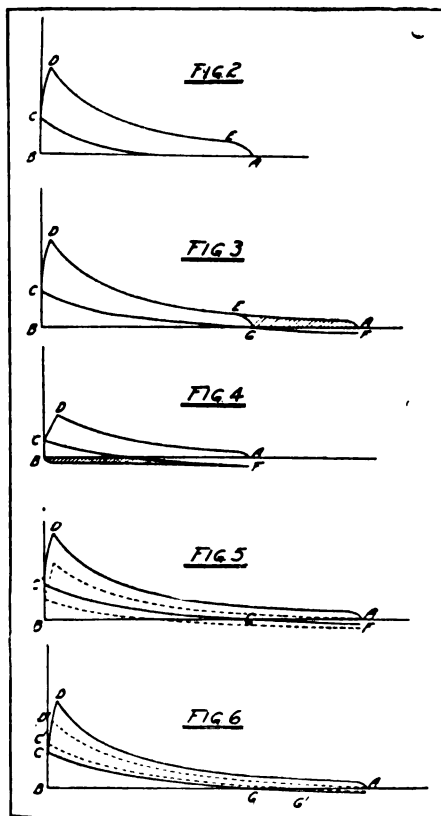
A cylinder full of mixture (AB) is compressed to C and ignited, raising the pressure to D, and as the piston moves down the pressure drops to E, where the exhaust opens.

It is necessary to open the exhaust valve from 40 degrees to 60 degrees before the end of the working stroke in order to get rid of the back pressure on piston during the exhaust stroke. The release of this pressure, 30 to 40 pounds absolute, with its accompanying "bark," visible flame and red-hot exhaust manifold, is ample evidence of thermal inefficiency, even without the proof deduced by a diagram analysis, or heat balance.

Increased Expansion.

If, instead of releasing a less volume of hot gas than the volume of cold mixture at the beginning of compression by opening the exhaust at E (Fig. 2), we carry the expansion of the burning charge 50 per cent. further, releasing the gases at a lower pressure, at a lower temperature and at a point nearer the end of the working stroke, more heat will be turned into work, because less will be rejected in exhaust, less power will be required to open the exhaust valves, and the function of the muffler will become extinct.

Fig. 3 shows a full load diagram of an



Indicator Diagram of an Internal Combustion Engine Under Varying Conditions.

riation seem to offset any thermal losses due to increased surface per unit of volume, a characteristic indigenous to this type.

Even with a spherical explosion chamber the ratio of the surface to the heat within decreases with compression, therefore the higher the compression the less cooling surface per unit of heat is exposed. The limitation of high compression is, of course, premature ignitions, a condition incompatible with successful operation.

The possibilities of increasing the thermal efficiency of automobile engines by decreasing the jacket losses lies then in

engine carrying the expansion 50 per cent. longer than the compression stroke, in which AB represents the length of cylinder and atmospheric pressure.

The piston, starting at B, the beginning of stroke drawn in a charge to G, when admission is closed, and the absolute pressure in cylinder drops to F when piston reaches A at the end of the stroke. FC represents the compression line which crosses the atmospheric line at G.

With the same clearance as an engine having a stroke BG, the compression BC, the firing line CD and the expansion line from D to E, with the same mixture and timing, would not vary from those of the ordinary engine, but the shaded portion of the diagram EAG would represent the gain in power, using the same amount of fuel, by expanding 50 per cent. more than the induction stroke.

The shaded portion of the diagram averages 16 per cent. to 20 per cent. of the whole, indicating a 20 per cent. to 25 per cent. increase in thermal efficiency, or a corresponding increase in power from the same amount of fuel. An engine using such a cycle may weigh a little more per horsepower output, just as a long stroke motor is heavier than an engine with a square cylinder, and on account of the long stroke per pound of M. E. P. may have more mechanical friction, but, while the cooling surface per heat unit introduced is increased, the difference in temperature during the last third of the working stroke is so slight that an additional transfer of heat seems improbable.

The exhaust of an engine expanding its burning charge 50 per cent. more than its compression stroke shows but a trace of flame, an evidence of complete combustion in the cylinders, where it belongs, and a reduction of the terminal temperature of about 1000 degrees F.

If the thermal efficiency is increased, the disposition of the rest of the heat is immaterial, though observation indicates that, while the loss in friction and water jacket is but slightly increased, the exhaust loses what the thermal efficiency gains.

The average heat balance of five full load tests from a 50-horsepower 10x20-inch engine, cutting off at about two-thirds its stroke, using the high value of fuel, is as follows:

Thermal efficiency on B. H. P.	26.02
Engine friction	4.86
Radiation and exhaust	22.59
Water jacket	46.48

Of course this high efficiency would be obtained only at full load or with an open throttle, a condition that seldom occurs in an automobile engine.

Partial Load Inefficiency.

With an advanced ignition and a throttled mixture with its low compression in an ordinary automobile engine, the terminal pressure will approach atmospheric, but the loss from wire drawing and the low compression is probably more serious than the exhaust gas losses at full load.

Fig. 4 shows the diagram of the ordinary automobile engine developing, but partial load with the ignition advanced to compensate for the slow burning mixture, in which AB represents the atmos-

pheric line and the piston travel; BF the rarefaction during the induction stroke; FC the compression; CD the firing and DA the expansion line. The shaded portion shows the back pressure or loss in every cylinder during the partial load.

As the area of the shaded part of the diagram, or the negative load, must be offset by a like amount of area above the atmospheric line, the fuel consumption of an idling engine is necessarily great, and because the average load on an automobile engine in which the intake is throttled necessarily has some back pressure, the thermal efficiency must be low.

Tests have demonstrated that an engine driving a car on a smooth road at 20 miles per hour will require no more fuel than when idling at the same speed. Every engine whose speed is regulated by the throttle opening develops a negative load which must be overcome by an equal positive pressure before it will deliver available power. This negative load decreases with a wide open throttle, a condition, however, seldom obtained. The absolute pressure in the inlet manifold when car is operating at about one-half its maximum speed, or say 20 miles per hour, averages about eight pounds, therefore approximately seven pounds more

the author's opinion, is to automatically advance the time of ignition directly as the speed and inversely as the load—a combination which will insure the best economy during all ranges of load. With a late spark and slow burning mixture it is possible to generate more heat in the exhaust manifold than in the engine cylinders.

Cut-Off vs. Throttling.

In order to prevent the wire drawing loss shown in Fig. 4, closing the admission valves earlier instead of throttling the mixture will reduce the M. E. P. without creating a back pressure, eliminating light load losses except those indigenous to low compression.

If the maximum cut-off is two-thirds the working stroke (Fig. 3), other conditions being the same, and we make this cut-off earlier as the load decreases, we will maintain a higher thermal efficiency during the whole range of load than is possible in the automobile engine controlled by a throttle in the suction pipe.

Fuel Ratio.

A carburetor properly designed for efficiency should provide a weaker mixture as the compression increases. A mixture too weak to ignite at atmospheric

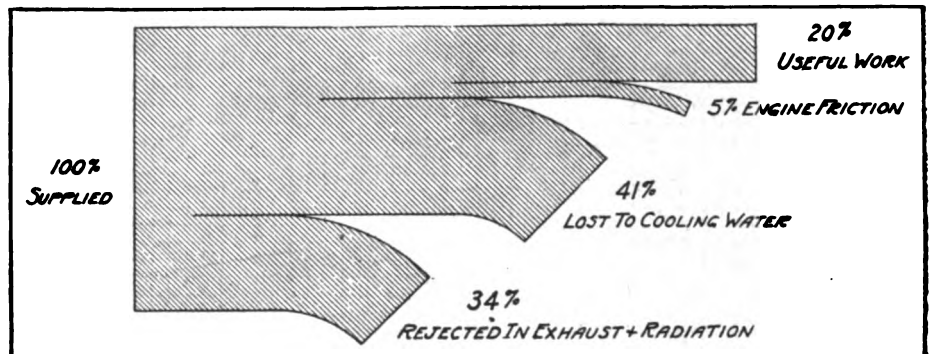


Fig. 1—How 80 Per Cent. of Heat Is Lost Under Ordinary Conditions.

M. E. P. than the net load requires is necessary under the average condition.

When idling, an engine may be working against from 10 to 12 pounds back pressure, a sufficient cause for its high fuel consumption under no load.

Tests of a 4½x5½-inch six-cylinder engine in 1912 by the Automobile Club of America showed the following thermal efficiencies:

Full throttle, R. P. M. 1113	17.8%
One-third throttle, R. P. M. 1039 ..	15.1%
One-sixth throttle, R. P. M. 266	6.2%

The loss from low compression caused by a greater surface for heat absorption per unit of volume is not shown on diagram, but manifests itself when a heat balance is obtained.

As the load becomes lighter, the compression less, and the mixture weaker from having a larger per cent. of carbon dioxide, the inflammation is necessarily slower, and the desirability of an earlier ignition is apparent if the maximum efficiency under adverse conditions is desired.

While the car driver could, if he would, keep his ignition as early as possible consistent with smooth running, and in so doing maintain the highest possible efficiency, the ultimate solution of the timing problem for our present motors, in

pressure will fire and do work if sufficiently compressed. A rich mixture is necessary in starting and with partial load, because the exhaust product content being constant and the compression less, the combustible molecules are not sufficiently close for proper chemical action, therefore there should be more of them in the same space to get rapid and efficient firing.

Blast furnace gas having as low as 90 B. T. U. per cubic feet, making 45 B. T. U. when mixed with a like amount of air, will not burn at atmospheric pressure, yet makes an ideal fuel when compressed to 180 pounds gauge.

Air containing less than 50 B. T. U. of gasoline vapor per cubic foot will not burn at atmospheric pressure, but when compressed sufficiently high will fire and do useful work.

If the molecules of a hydrocarbon are driven too close to the molecules of oxygen by compression, the generated heat will cause spontaneous combustion, but with a weak mixture high compression is necessary to bring them to a normal ignitable relation, therefore compression may be increased indirectly with the heat units supplied.

In a Diesel engine in which the heat of compression is always sufficient for ignition, combustion takes place even with

the smallest possible injection of fuel.

It is quite evident, therefore, for efficiency in automobile engines, that the fuel per unit should be less as compression increases to prevent spontaneous ignition and conversely should become richer as the pressure decreases for a high mean effective pressure.

High Compression.

The higher the compression, other things being equal, the greater the thermal efficiency, yet the compression must be below the critical point of premature ignition. If we weaken the mixture as the compression increases, the relation of the combustible molecules will remain constant, maintaining practically the same rapidity of inflammation.

If a motor is designed to give a maximum compression and full rated load at two-thirds cut-off, as shown in full line diagram (Fig. 5), a better efficiency will be obtained at full load than is obtained in the ordinary automobile engine, be-

If, instead of moving the point of cut-off G towards B, leaving the mixture practically constant, but taking in less gas, as less load is required, we move the cut-off point G towards A, or to G' (Fig. 6), and at the same time decrease the fuel per unit of air, the compression will be increased, rapidity of inflammation will remain practically constant, premature ignition will be improbable, the thermal efficiency should be practically as high as at full load and the initial pressure should be less, insuring smooth running at light loads.

If the fuel is diminished as the compression increases in such a manner that there will be just enough fuel at maximum compression to drive the engine idle, and at the earliest cut-off to give the maximum M. E. P., the adjustment is complete. Should the fuel diminish faster than the compression increases at the latest cut-off, there would be a negative M. E. P. of compression and the engine would stop. Between extremes,

governs the theoretical compression can be maintained at unity as the flexible denominator of the equation can be readily varied.

If the compression at two-thirds cut-off and maximum load is 90 pounds absolute, the maximum compression at no load would be practically 144 pounds, yet so attenuated would be the mixture that premature ignition would be impossible.

In Fig. 7 thermal efficiency curves AB, CD and EF were obtained from tests by the Automobile Club of America of automobile engines, and probably show the average thermal efficiency of the majority of engines of this type.

While the available efficiencies of complete expansion engines are for full load and from larger cylinders, the total horsepower is practically the same as the horsepower of the engines from the tests of which the three curves were plotted.

The probable efficiency curve which would be obtained from an automobile engine expanding the working medium 50 per cent. further than the induction stroke, but cutting off earlier as the load gets lighter, is shown at GH, while IH is theoretically the efficiency curve of a complete expansion engine, in which the compression is increased inversely, and the fuel directly as the load.

In solving the mechanical problem provision is made for retarding the beginning of compression when cranking, thereby introducing with the normal high compression no starting difficulties.

A standard carburetor would require no change in adjustment for full load, but would require a fuel opening which would vary inversely with the amount of air induced.

The fuel valve and cut-off lever would be connected together and operated by the accelerator pedal or hand lever on steering wheel.

The rarefaction of the mixture in cylinder at full load induces expansion, gasification and a thorough commingling of the combustible molecules before compression, a condition which insures rapid ignition and perfect combustion.

The smoking of a motor is usually caused by the pressure in the crank case driving the oil past the piston to the combustion chamber during the rarefaction developed with a closed throttle and light loads. As more oil is required at full load than when motor is idling, the cycle proposed promises more rarefaction at full load than at light loads, insuring a proper oil distribution during the whole range.

Conclusion.

While the thermal efficiency of complete expansion engines has been excelled only by engines of the Diesel type, there may arise unforeseen difficulties in increasing the compression inversely as the load, yet the possibility of developing an automobile motor whose thermal efficiency is at least 15 to 20 per cent. higher than the best engines extant, and one in which the efficiency is as high at the partial load at which it is usually run as at full power, should be of vital interest to the automobile industry of today.

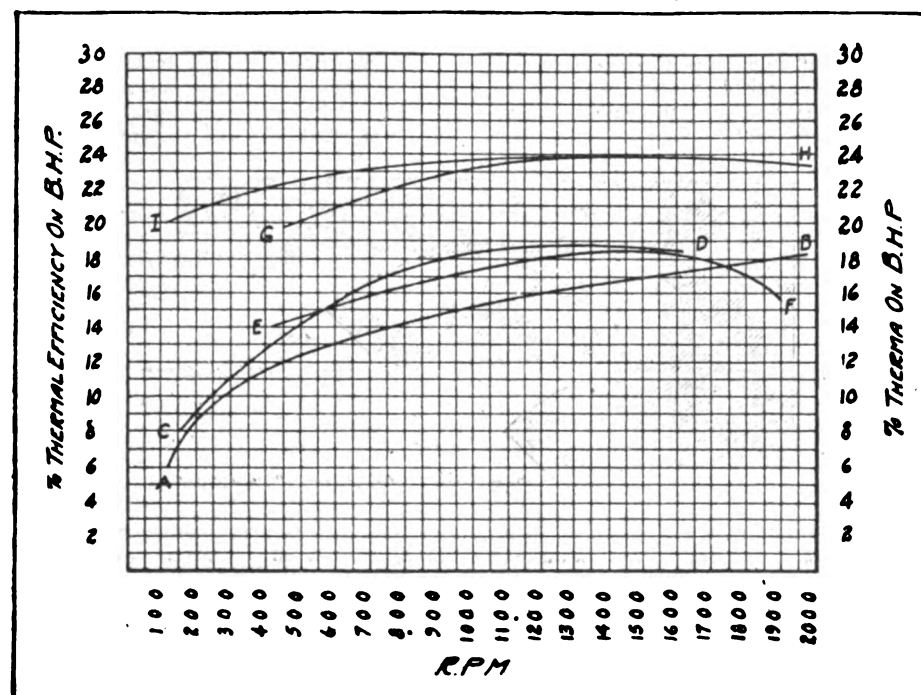


Fig. 7—Thermal Efficiency Curves Based on Tests by the Automobile Club of America and Probable Results Suggested by Mr. Sargent.

cause less heat goes out with the exhaust and more is turned into work.

It already has been shown that if the point G is moved towards B as the load gets lighter, there will be no loss from wire drawing, but as the compression decreases the efficiency will become less, the molecules further apart and inflammation slower. Therefore the ignition must be advanced to obtain the dotted diagram in which the firing line is practically parallel to CD.

Such a method of governing would materially increase the efficiency at half or partial load, which is the load most usually required of an automobile engine.

As an internal combustion engine which has no compression and fires at atmospheric pressure requires about five times as much fuel per B. H. P. hour as an engine compressing to five atmospheres running on the Otto cycle, the desirability of keeping up the compression can readily be seen.

full and no load, the fuel compensation is automatic, insuring complete and smokeless combustion.

Such a cycle provides for a maximum or at least an average efficiency through the whole range of load. It eliminates the inefficiency of wire drawing and low compression. It provides a fixed fuel adjustment for full load with speed compensation only required. As the load gets lighter the fuel valve is throttled and the closing time of the induction valve retarded, a most simple mechanical problem.

In such a cycle the molecular arrangement is such that the speed of inflammation is practically constant for all loads, therefore the time of ignition need be advanced only with the engine speed to get a uniform angle to the firing line.

With such a cycle volumetric efficiency

$$\left\{ \frac{\text{Volume of gas induced}}{\text{Volume of induction stroke}} \right\} \text{ which}$$



A car owner residing in Massachusetts, who has been prosecuted under the recently adopted lighting ordinances, decided to do as much night driving as possible without the use of the headlights. In Fig. 166 is shown how he located the side oil lamps over the front mudguards so that their full efficiency might be gained.

At B is shown the shape of the bracket that is required for the installation. They are attached by the same bolts which are used to retain the mudguards. It is necessary to drill a small hole in each guard so that the projecting end of the bracket which holds the lamp may be passed through. This arrangement brings the light closer to the road.

While this suggestion will no doubt be practical on large cars, on smaller ones trouble may be experienced through vibration caused by the extra weight of the lamps. If excessive vibration should occur it should be easy to extend some type of brace between the two lights without detracting from the appearance of the car.

QUICK REFERENCE TABLE.

Having determined the number of cubic inches in any bar, if it be steel, its exact weight can be obtained by multiplying the number of cubic inches contained by the decimal .2833. If only a rough estimate of the weight is required the number of cubic inches should be multiplied by .3. If the bar be of wrought iron use .28 as a multiplier. To determine the weight of cast iron multiply by .26.

The following table will serve as a quick reference for obtaining the weights of different sizes and shapes of steel

bars, the calculation being for one foot bars and the sizes in inches:

Round		Square		Octagon	
Size	Lbs.	Size	Lbs.	Size	Lbs.
1/8	.04	1/8	.05	1/8	.04
1/4	.17	1/4	.21	1/4	.18
3/8	.38	3/8	.48	3/8	.40
1/2	.67	1/2	.85	1/2	.70
5/8	1.04	5/8	1.33	5/8	1.10
3/4	1.50	3/4	1.92	3/4	1.58
7/8	2.04	7/8	2.60	7/8	2.16
1	2.67	1	3.40	1	2.82
1 1/8	3.38	1 1/8	4.30	1 1/8	3.56
1 1/4	4.17	1 1/4	5.31	1 1/4	4.40
1 3/8	5.05	1 3/8	6.43	1 3/8	5.32
1 1/2	6.01	1 1/2	7.65	1 1/2	6.34
1 5/8	7.05	1 5/8	8.98	1 5/8	7.32
1 3/4	8.18	1 3/4	10.40	1 3/4	8.64
1 7/8	9.38	1 7/8	11.90	1 7/8	9.92
2	10.71	2	13.60	2	11.28
2 1/8	12.05	2 1/8	15.40	2 1/8	12.71
2 1/4	13.60	2 1/4	17.20	2 1/4	14.24
2 3/8	15.10	2 3/8	19.20	2 3/8	15.88
2 1/2	16.68	2 1/2	21.20	2 1/2	17.65
2 5/8	18.39	2 5/8	23.50	2 5/8	19.45
2 3/4	20.18	2 3/4	25.70	2 3/4	21.28
2 7/8	22.06	2 7/8	28.20	2 7/8	23.28
3	24.10	3	30.60	3	25.36
3 1/8	26.12	3 1/8	33.13	3 1/8	27.50
3 1/4	28.30	3 1/4	35.90	3 1/4	30.28
3 3/8	30.45	3 3/8	38.64	3 3/8	32.10
3 1/2	32.70	3 1/2	41.60	3 1/2	34.56
3 5/8	35.20	3 5/8	44.57	3 5/8	37.05
3 3/4	37.54	3 3/4	47.80	3 3/4	39.68
4	42.72	4	54.40	4	45.12
4 1/4	48.30	4 1/4	61.40	4 1/4	50.84
4 1/2	54.60	4 1/2	68.90	4 1/2	56.96
4 3/4	60.30	4 3/4	76.70	4 3/4	63.52
5	66.80	5	85.00	5	70.60

TOOL BOX.

There is space on practically every truck for the fitting of an extra tool box. One can be attached under the body at the rear of the car, as shown in Fig. 167, being held in position by two metal straps. The entrance to the box is through a hinged door at the rear. Chains, heavy tools, ropes, etc., may be conveniently carried here. The door may be locked by a padlock and staple.

SPARK PLUG SUGGESTION.

When tuning up new cars, it is customary to use an excess of oil in the crank case so as to prevent damage to bearings, and in some machines the spark plugs may become saturated. This condition causes sooting and poor ignition.

If the plugs used are of the long nosed design, the trouble may be overcome by adding two or more copper washers between the plug and the cylinder. This will raise the electrodes higher in the cylinder, so that they will not be so easily splashed. Of course a slight decrease in compression will result, but the loss will be but trifling compared to the benefit derived.

EFFICIENCY OF DRY CELLS.

Whether the dry cells be wired in series or multiple series to form a battery, its efficiency will be greatly impaired if one or more is decidedly lower than the others. Test each cell individually with an ammeter and remove any which has an amperage considerably below that of the others.

CLEANING SHELLAC BRUSHES.

When making repairs the motorist and the mechanic frequently has need for shellac. A brush which has been used to coat this substance may be readily and easily cleaned in soap and water if done promptly after using. It cannot be cleaned in this manner if the shellac has been allowed to set. Alcohol is generally used for this purpose because of its cutting action on gum, which is the principal ingredient of shellac.

If a cupful of kerosene be added to a bucket of water when washing the running gear of the car, the operation of removing grease and mud will be made much easier. If the highly varnished finish has disappeared from the body, the same solution may be used for washing.

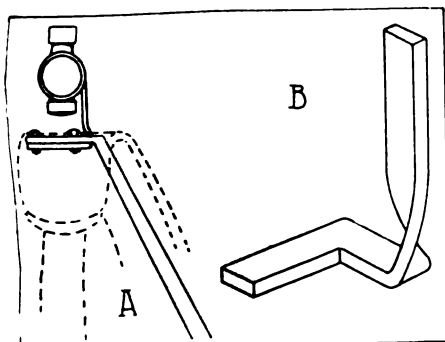


Fig. 166—A, Showing Side Light Attached to Fender Bracket; B, Formation of Lamp Bracket.

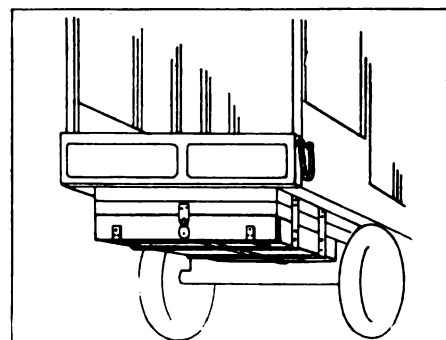


Fig. 167—Utilizing Space Under Truck for Attachment of Convenient Tool Box.

KEEPING FEET WARM.

In cold weather it is almost impossible for the operator of a car to prevent his feet from becoming cold and numb. If

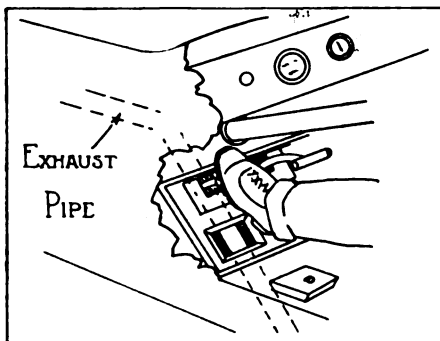


Fig. 168—A Small Cover Cut in the Front Floorboard Will Permit Heat from the Exhaust Manifold to Warm Operator's Feet.

he places a blanket over them there is danger of not being able to free the feet from the blanket when it is necessary to use the pedals. If large overshoes are worn, then the feet become ponderous. An operator who does much driving in country districts in cold weather writes that he keeps his feet warm by allowing the heat from the exhaust manifold to come through a small slot cut in the front floorboard, as shown in Fig. 168. The sides of the floor cover are cut on an angle so that it can be quickly replaced at any time. He also has constructed a canvas cover, which attaches to the side of the car and to the dash by top fasteners. This fits over the steering wheel and does not interfere with the manipulation of the foot pedals or the operation of the gear lever.

LOCATING CYLINDER LEAKS.

Often a small flaw in the cylinder casting will allow water to seep into the combustion chamber. If the crack is very minute it may not be perceptible to the naked eye, in which case it may be located by testing the casting with steam pressure.

The water outlets, with one exception, are plugged. The open one should be coupled with a pipe leading from a steam boiler. By using about 20 pounds pressure, even the smallest leak may be found readily. The crack should, of course, be welded by the autogenous method.

INSTALLING STORAGE BATTERIES.

One of the chief causes of storage battery injury is the jolting which the units receive when in actual service. Improved boxes have provision for securing the battery to the floor. If the battery is allowed to be jolted around the case is apt to become strained or chafed and permit some of the electrolyte to leak out.

This can be overcome by making the container larger than the battery and forcing between the latter and the walls of the box, small, air tight rubber balls,

such as children play with. These will hold the battery in place and also absorb shocks.

PRESERVING INNER TUBES.

A garage man who has had considerable experience in storing machines advises that the following treatment will keep the inner tubes soft: Remove them from the shoes and immerse in hot water for about 10 minutes, then remove and carefully dry.

Another method which is said to be practical in preventing the deterioration of rubber is to utilize a solution of alcohol and turpentine. The latter is poured into the alcohol, and when applied to the tube the spirit will evaporate, leaving a thin protective coating of turpentine. Tires may be treated similarly.

PRESSING IN BALL RACES.

In many of the earlier makes of cars the ball races in the wheels are so tightly forced in that it is a difficult task to remove them when worn. They are made of hardened pressed steel and if the member cannot be broken out with a cold chisel and hammer, it will, no doubt, be necessary to draw the temper. When fitting the new race care must be taken, if a hammer is used, to force the member in place, else breakage is apt to result.

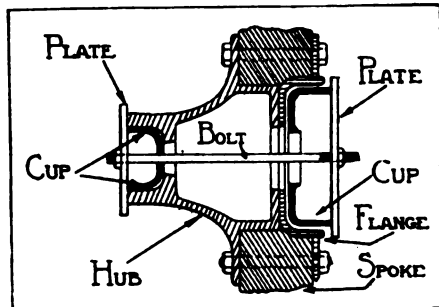


Fig. 169—Equipment for Pressing in Ball Races in Wheels.

A much better method than hammering is suggested by the device illustrated in Fig. 169. It consists of a bolt threaded at both ends to take a nut and two quarter-inch metal plates. The operation is obvious. By tightening the nuts the race will be forced in straight, because an even pressure is brought to bear. This method may also be used for forcing in brass and bronze bushings when the usual driving method is apt to burn them.

TESTING GASOLINE LEVEL.

Repair men state that the best result's in testing the gasoline level can be obtained by removing the carburetor from the car and setting the level when on the bench. The reason for this is that if the needle valve does not properly seat, the liquid will seep by and drain from the bottom of the instrument. In Fig. 170 is illustrated an apparatus which will prove satisfactory for the test. It consists of a discarded grease pail which has a small valve inserted and soldered to the bottom. A nipple is next sweated into a short length of flexible copper

tubing and the connecting nut placed over the tubing. This assembly is then connected to the tank by a suitable length of rubber tubing.

By clamping the carburetor in a vise and connecting it with this small storage tank, the level test may be conducted for any length of time and a slow leak detected. This method also affords more light and room for the work man.

METAL POLISH.

A satisfactory polish for brass, nickel or silver is made of two parts alcohol, one part ammonia and enough whiting to form a liquid having a cream like consistency. This preparation is smeared over the work and allowed to dry. When brushed off with a soft cloth, the metal will appear bright. The alcohol and ammonia dissolve all dirt and oxides. These are absorbed by the whiting and are removed with the powder. If a good quality of whiting is not available, ordinary starch powder may be used.

TO WATER PROOF CANVAS.

An easy method of water proofing canvas is to dissolve soft soap in hot water and then add a solution of sulphate of iron. The canvas is washed in the solution, dried and then coated with linseed oil. The soap prevents the oil from becoming hard and water has no effect on it.

PREVENTING CHATTERING.

An experienced machinist advises that a large hole can be drilled from the start without jumping and chattering of the drill by placing a piece of cloth about the size of the end of the drill under the point and drilling through it. This suggestion can also be adopted with success in countersinking work which requires a clean finish.

TO BLACKEN ALUMINUM.

A simple method to blacken aluminum is to polish the metal with the finest emery cloth obtainable, after which a thin layer of olive oil is smeared over it and the part heated slowly over an alcohol flame. To obtain uniformity of the coating the part is treated to a second coat of oil and again slowly heated. The action of the heat first causes the metal to turn a brownish color and then black, depending, of course, on the degree of heat. When the desired tone has been

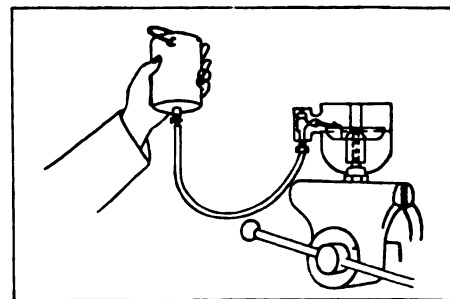


Fig. 170—Method of Setting a Carburetor Gasoline Level When the Instrument Is Removed from the Machine.

achieved, allow the metal to cool and polish with a woolen cloth or soft leather.

A second method is to mix one ounce of white arsenic, one ounce of sulphate of iron, 12 ounces of hydrochloric acid

WIRE STRIPPER.

A handy and easily made tool for cutting the insulation away from the ends of electric wires is shown in Fig. 171 C. It

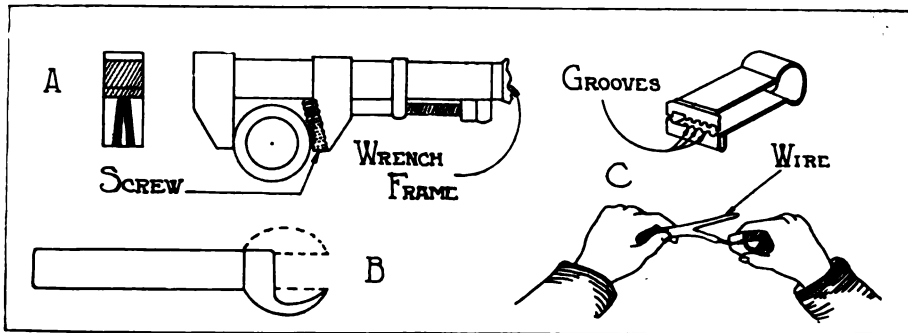


Fig. 171—A, Showing Groove Cut in Movable Jaw and Monkey Wrench Converted into Pipe Wrench; B, Broken Set Wrench Ground to Make Cotter Pin Puller; C, Handy Tool for Stripping Insulation from Cables.

and 12 ounces of water. When the arsenic and iron are dissolved by the acid, add the water. Thoroughly clean and wash the part to be colored before immersing in the bath. When the desired color is obtained, remove the part and dry with fine sawdust and then lacquer.

USEFUL MONKEY WRENCH.

The monkey wrench is one of the handiest tools in the equipment of motorist or repair man. In Fig. 171 A is shown how the use of this tool may be extended by converting it into a pipe wrench. A small groove is milled on a taper in the movable jaw and in it is placed the threaded section of an old bolt. The threads should, of course, be hardened. This arrangement does not prevent the tool being used as an ordinary wrench. This double purpose makes it handy equipment to carry in the tool box.

EASILY MADE COTTER PULLER.

Frequently when great pressure is exerted on a straight set wrench, one of the jaws will become broken. In such cases do not scrap the tool, as it may be possible to convert it into a handy cotter pin puller as illustrated in Fig. 171 B. Grind the broken jaw flush with the recess and then grind the good jaw down to a long, slim point. The shape of the jaws makes for a rocking motion and cotter pins can be easily removed.

consists of a suitable piece of $\frac{1}{8}$ -inch sheet steel formed as illustrated. At one end of the jaws the metal is ground to an edge, while grooves of various sizes are cut in the remainder of the jaws. The tool is then tempered. The sharpened section is for cutting the insulation, while the grooves are for stripping it from the wire.

AXLE SUPPORTS.

The life of tires can be materially lengthened if all four wheels of the car

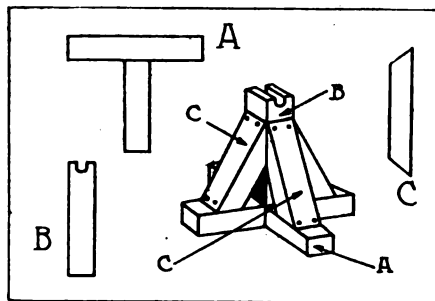


Fig. 172—Easily Made Jack for Supporting Car; A, Formation of Upright and Horizontal Pieces; B, Groove Cut in Top of Upright Member; C, Angle Ends of Supports.

be jacked up when leaving the machine in the garage. A device for the purpose can be made by any motorist handy with tools. A working plan is shown in Fig. 172. Each support consists of eight pieces, two by four-inch joists being used for the purpose. The first step is

to cut two lengths and fasten them together as shown at A. The part designated by B is recessed at one end so as to prevent the axle from slipping. The formation of the braces are shown at C. That the support may be of the proper height to hold the car off the floor, the measurement should be taken from the centre of the hub cap to the ground. An additional three inches should be allowed so that the tires will clear the floor. Four of these supports should be made, one for each wheel. The top of the support may be recessed to conform to the shape of the axle. Of course the proper way to place the axle supports is to jack up each end of the car in turn and slip them under.

NEW WRIST PIN.

In the Feb. 25th issue of The Automobile Journal appeared an article relative to a new wrist pin construction designed by T. C. M., South Boston, Mass. We make haste to state that the criticism was according to the facts at hand. Since then the inventor has submitted blue prints and complete description, thus casting a new light on the subject. From this blue print we have made the sketch shown in Fig. 173.

The assembly is designed with the intention that the piston will at all times be in alignment with the cylinder walls, regardless of the misalignment of all other factors. This is accomplished by retaining the piston on a universal joint. The wrist pin, which is inserted through the upper connecting rod bearing, does not fit into a boss in the piston. Instead, the piston is retained by the short pins which fit into special split bosses. With this construction, the piston is practically floating and its alignment is not governed by the action of the connecting rod or imperfect alignment of the bearings.

The principle appears to be a very good one. The only objection which might arise against such construction is the weight. The tendency is to reduce the weight of pistons. Several manufacturers are constructing them of aluminum and its alloys.

A light coat of alcohol, in which a little collodion has been dissolved, applied to the lamp reflectors, will prevent the silvery from tarnishing. This preparation is easily washed off with warm water.

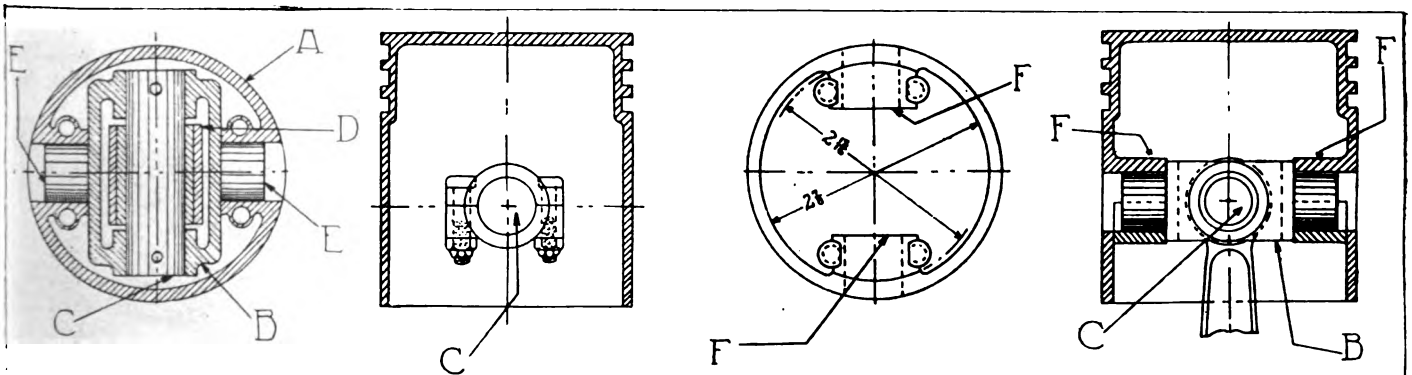


Fig. 173—New Type of Wrist Pin Invented by Massachusetts Reader; A, Piston; B, Universal Joint; C, Wrist Pin; D, Connecting Rod; E, Projections of Universal Joint That Attach to Special Bosses in Piston; F, Special Bosses.

MOTOR CAR ACCESSORIES AND EQUIPMENT.

BEMUS TIMER.

The construction of the Bemus ball contact timer for Ford cars is somewhat of a departure from conventional types. The only contact made by the Bemus roller is with four steel balls, which are adapted to yield against springs in the ball sockets as the roller passes them while travelling through the timing circuit. This design eliminates excessive wear and affords positive contact, easy starting and smooth motor operation.

In the 1916 model, illustrated herewith, numerous improvements and additional features have been embodied. The handles are reinforced and made unbreakable by a molded in steel bushing. The wearing life of the roller brush has been increased approximately four times by the eccentric location of the ball contacts and the lengthening of the roller, so that a track is provided for each ball. All wire connections are at the top of the timer, where they are accessible and protect the wires from the grease and water of the pan.

Manufactured by the Motor Specialties Company, Waltham, Mass. List price, \$2.25.

STRONG SIGHT FEED OILER.

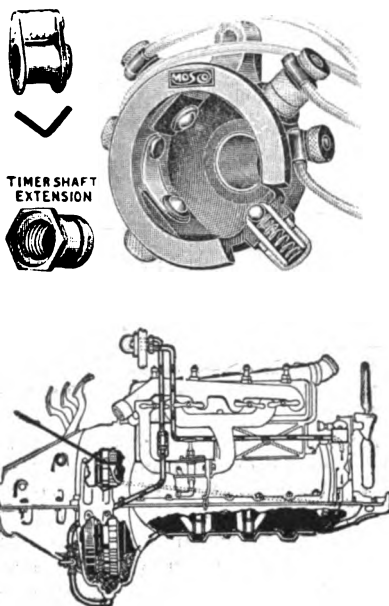
In the accompanying illustration is shown the Strong sight feed oiler for Ford cars completely installed on the engine. A convenient gauge located on the dash communicates to the driver whether or not the car is receiving proper lubrication. A special side plate takes the place of one of the regular Ford plates and contains the pump mechanism. The pump is operated directly from the valve through a rocker arm, which is raised with the piston travel. This is slotted to fit against the valve stem between the tappet and a special washer and is pivoted. The upper end is in contact with the end of the pump piston, the travel of which forces the oil to the engine.

This lubricating system positively circulates the oil, so that both the bearings and the lubricant are kept cool. Statement is made that there is a saving of oil and wear on the motor by its use.

Manufactured by the Perkins Manufacturing Company, Des Moines, Ia. List price, complete ready for installation, \$5.

BAY STATE AUTOKIT NO. 3.

The Bay State Autokit No. 3 is designed to meet all the requirements of Ford car owners. The set consists of a double-ended ratchet wrench, 11 heavy gauge pressed steel sockets, a heavy screw driver and a seven-inch extension steel shank. The sockets are case hardened and nickel plated, and include a special long one for removing spark plugs and one of special design to fit nuts on the Ford crankshaft bearings. The design is such that nuts and bolts fitting close to the wall are easily gripped. The outfit is neatly arranged in a strong,



black finished, lock cornered box, which is fitted with heavy brass hinges on the outside.

The maker of this outfit also manufactures numerous sets of wrenches designed for use on all cars. Among these is a new set which is given the trade name, Stickit. This consists of a double-ended ratchet wrench, strapped to seven strong stamped steel sockets strung on a square steel shank. One end of the wrench fits the shank and the other end the sockets. The wrench also fits four sizes of nuts and, with the sockets, 11 different sizes of nuts and cap screws. The ratchet wrench is fastened to the shank retaining the sockets by a substantial leather strap and shield. This arrangement, together with the use of a leather washer on the shank, prevents rattling when carrying the outfit in the car.

Marketed by George A. Cutter, Taunton, Mass. List price of the special set for Ford cars, \$4; Stickit sells at \$3.

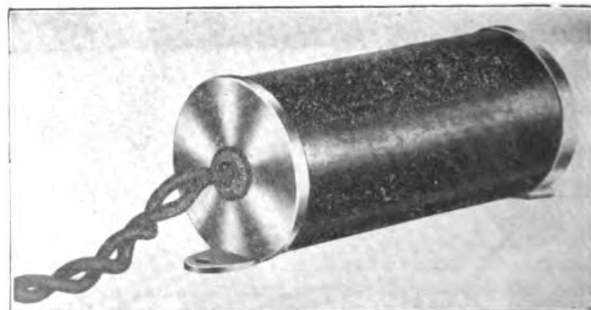
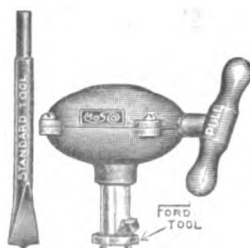
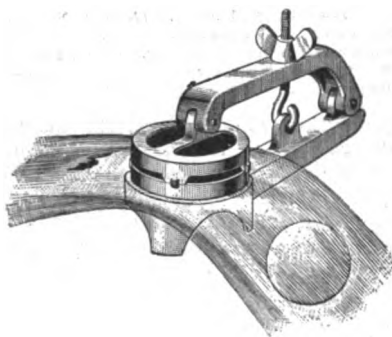
MARVEL JUNIOR VULCANIZER.

Illustrated herewith is the Marvel junior vulcanizer, which is small enough to be carried in the coat pocket, yet is of sufficient size to quickly and permanently vulcanize any puncture. The heat is produced from impregnated cardboard which burns, but does not blaze. The burning process is sufficiently long to vulcanize any one place. The advantage of this equipment is that there is absolutely no danger from fire. Wind cannot effect it and it is convenient and can be successfully operated by any one. It is designed for use on tubes only.

Manufactured by the Marvel Accessories Manufacturing Company, West 6th street and Lakeside avenue, Cleveland, O. List price, \$1.

MOSCO VALVE GRINDER.

The Mosco valve grinder is designed to render valve grinding an accurate mechanical operation rather than a guess work hand job. The handle at the side is attached to a chain coiled on a pulley inside the casing, and is intended to rotate the grinder tool. A spring, wound up clockwise, is fitted with a pulley so as to reel back any length of chain which has been unwound on the forward stroke. The work man pulls the handle forward and the spring pulls the handle back for



the return stroke, thus affording a partial turn of the valve in both directions.

It has been found that great speed can be obtained with this tool, resulting in superior finish to the seats. Only the best materials and workmanship enter into its construction.

Manufactured by the Motor Specialties Company, Waltham, Mass. List price, \$1.50.

EVENLITE.

The Evenlite, shown in the accompanying illustration, is a special type impedance coil which maintains the light of the Ford car at constant regardless of engine speed. Its purpose is to equalize the flow of current and thus prevent burning out of the lamps. Statement is made that this device consumes only one half the energy that the standard Ford lighting system uses from the magneto. Tests have determined that when the car is running at seven miles per hour, the Evenlite affords over five times the strength of the Ford light; at 10 miles per hour, three times as much; at 15 miles per hour, twice as much; and at 20 miles or over the light is even constant, regardless of engine speed.

Attachment is made to the dashboard under the hood beside the lighting switch. Full instructions accompany each instrument and installation can be made by any one very quickly and easily.

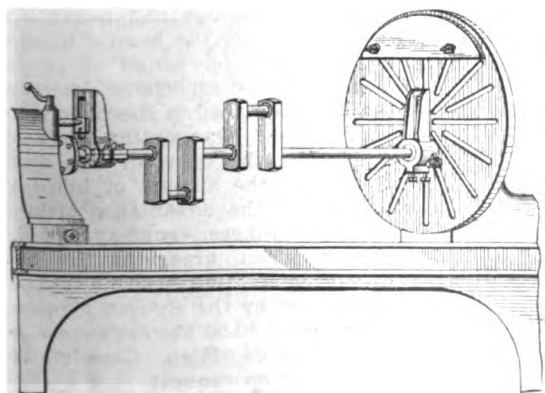
Manufactured by Fred J. Silhanek, 1541 Cleveland place, Denver, Col. List price, including nitrogen lamps, \$4.

LIGHTNING GARAGE SET.

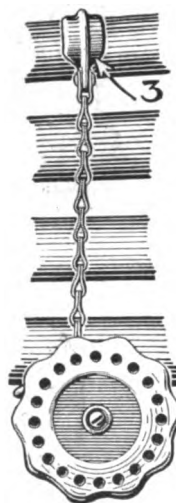
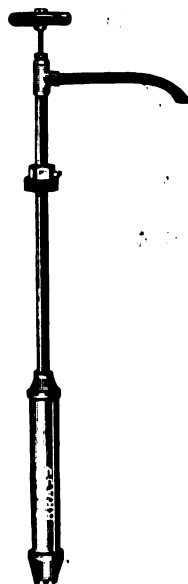
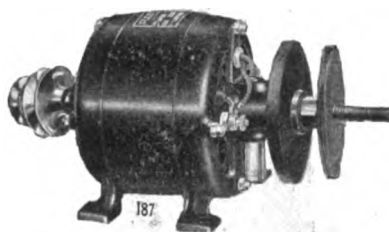
The new Lightning garage repair set No. 2501 for Ford cars is an assortment of taps, dies and reamers selected to meet the demand from garages and repair shops, and is based on experience in handling repairs on Ford cars. The tools are of the well known Lightning quality, which has been favorably recognized for nearly 45 years.

The assortment contains seven screw cutting sizes, plug taps and round adjustable dies, spiral fluted reamers, stock for round adjustable dies and a "T" tap wrench of the adjustable pattern. The outfit weighs 4¼ pounds.

Manufactured by the Wiley & Russell Manufacturing Company Division, Greenfield Tap and Die Corporation, Greenfield, Mass. Price, \$14.50.



The prices given with these descriptions are the latest retail quotations by the manufacturers or distributors, and they are subject to change without notice. When addressing the manufacturer or distributor always mention The Automobile Journal to insure immediate attention.



GENERAL UTILITY MOTOR.

The general utility motor illustrated herewith is designed to be used in connection with grinding or polishing automobile parts. All pieces which have accumulated rust can be brightened in a few minutes by polishing them on the buffing wheel and burrs on castings can easily be removed by grinding on the emery wheel. The driving shaft extends on both ends of the motor. One end is equipped with a double groove pulley, which permits the use of the motor for driving small machinery, such as a drill press, lathe, scroll saw, filing machine, etc. The motor is well built, cool running, has liberal size bearings and overhead oiling system.

Manufactured by the Reynolds Electric Company, Chicago, Ill., and New York City. Complete description and price on request.

BINKS TRANSFER PUMP.

The Binks No. 45 transfer pump is designed for use in transferring oils and other liquids from a barrel to another receptacle. The pump is substantially constructed, having an all-brass cylinder of 1½ inches in diameter and 12 inches in length. Other equipment consists of an all-brass plunger, brass ball valves and brass seats. No leather or rubber is used in this construction.

To the vertical discharge pipe is attached an adjustable iron plug that can be screwed into the bung of any steel barrel. When in place it can be rigidly fastened with set screws.

Manufactured by the Star Brass Works, 319-331 N. Albany avenue, Chicago, Ill. List price, \$4. When ordering it should be stated whether pump is to be used with 1½ or two-inch bung.

ADAMS TOP HOLDER.

The Adams top holder is designed to hold and prevent rattling of an automobile top when down. This is accomplished by the adjustment of the chain being such as to tighten every 1/16 of an inch. It is possible to draw the chain tight or to loosen it instantly. The saddle and hook of the holder are leather lined and cannot mar the bows of the car.

It can be attached in about two minutes. The holder is placed over the end of the top retaining iron and the top lowered so that the bows rest properly in the saddle. The installation is completed by tightening a set screw at the bottom of the holder.

These holders are made with ½ and ¾-inch holes. All small cars use the former size, while the large cars require the latter. The chain used is of steel, sherardized and electroplated. Its tensile strength is 465 pounds.

Manufactured by the Rock Island Manufacturing Company, Rock Island, Ill. List price, \$1.25 per pair.



MANTHA CRANKSHAFT HOLDER.

When overhauling an engine, the repair man often does not true the crank pins because he has not the proper tool for this kind of work. In consequence, the pins become worn and the connecting rods loose, which results in a dissatisfied customer. The crankshaft holder shown herewith is designed to prevent this happening. It is adjustable and can be fitted to any crankshaft and regulated to any size stroke. It also can be attached to camshafts, eccentric discs and to practically any engine part that is turned to an eccentric. They frequently can be used as dogs or drivers in cases where it is difficult to use full sized chucks.

The holder may be set to the thousandth part of an inch, which is done by the centres being operated by screws, which when set in the proper place are locked by a nut. This prevents them from shifting from their positions. One set of Mantha holders is designed to take shafts up to 1½ inches, and another set will take them up to three inches. Other sizes can be made to order.

Manufactured by the William L. Mantha Company, Inc., Bayport, N. Y. List price of 1¾-inch set, \$12; price of three-inch set, \$15.

TENOX LIQUID GASKET.

Tenox liquid gasket is a preparation designed to replace copper, asbestos, fibre or other gaskets. It is applied to the faces of flanged joints with a brush. The joint is then assembled and the liquid gasket will automatically adjust itself to meet the requirements. The gasket so formed will fill any irregularities in the faces of the flanges.

This preparation is not affected by heat, oil, water or gasoline and will not blow out under any pressure found in modern gas engine construction. Among many of the leading engine builders, the Buffalo Gasoline Engine Company and the Continental Motor Manufacturing Company are two prominent concerns which state that this preparation fulfills perfectly all the functions of a gasket.

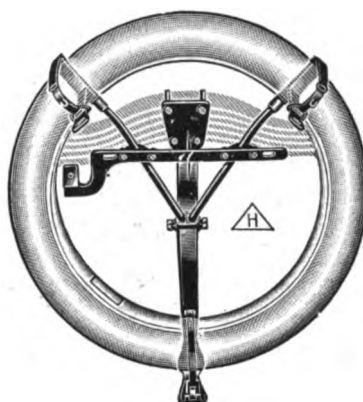
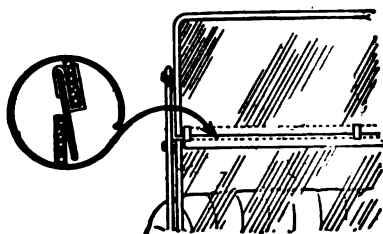
As shown in the accompanying illustration, this material is put up in cans of various sizes, ranging from ¼ pint to cans containing one gallon.

Manufactured by the Stone Manufacturing Company, 136 Liberty street, New York City. List price of can containing ¼ pint, 20 cents. Write for prices of larger quantities.

PARAMOUNT IGNITION.

The Paramount interrupter, illustrated herewith, consists of a bracket containing a vertical shaft which operates a cam having 32 teeth. These teeth operate against a breaker arm, breaking the circuit mechanically and automatically at exactly the proper instant during each revolution of the crankshaft. This ignition system entirely eliminates the use of the vibrators.

The interrupter attaches to the front end of the crank case and the vertical shaft is operated by the engine camshaft. The Ford commutator is removed and



placed above the interrupter as shown in the illustration. The vibrators are rendered inoperative and the Paramount instrument is wired into the circuit between the coils and magneto. No battery is required, the current from the Ford flywheel magneto being used. The advantage of this mechanical system of interruption is that the current is equalized in each cylinder.

Manufactured by the Detroit Engineering Products Company, Detroit, Mich. List price, \$25.

CLEAR VIEW RAIN GUARD.

The Clear View rain guard shown in the accompanying illustration consists of a flexible, transparent strip, designed to clip to the lower edge of the top glass of the windshield. Its purpose is to fill the crack between the upper and lower glass of the clear vision windshield, and prevent rain from working into the driver's compartment.

Statement is made that the harder the rain beats against it, the tighter it becomes. It can be attached or detached almost instantly.

Manufactured by the Clear View Rain Guard Company, 205 West Lombard street, Baltimore, Md. List price, \$1 each.

REAR TIRE HOLDER.

The Humboldt rear tire holder, for model T Fords, fastens to the rear frame in an easily accessible manner. The license bracket is rigidly clamped around the two vertical supporting arms, thus eliminating any possibility of the lamp blowing out due to vibration. The locking base is another noteworthy feature, making the tires secure against theft.

The tires are carried in a vertical position clear of the exhaust. The holder is strongly built from malleable iron and steel throughout and finished in the company's own baked ebony enamel. It is suitable for carrying either one or two tires. Each set is packed complete with straps in an individual carton. This tire holder is known as No. 1287.

Manufactured by the Humboldt Machine and Stamping Company, 81 Tenth street, Long Island City, N. Y. Price, \$3.75 each.

RUNYEN'S GREASE CABINET.

Runyen's self-measuring grease cabinet, shown on this page, is a convenient combination of a container and substantial pump for greases and heavy oils. With each stroke of the handle it delivers exactly a quarter pound of grease. This equipment is especially desirable, as the nozzle is placed in the opening of the gear box and by counting the number of strokes, the operator can definitely determine the amount of lubricant used. Some of the advantages claimed for it are cleanliness, economy and the delivery of clean grease to the gear boxes. The cabinet is made in two sizes.

Manufactured by the Runyen Manufacturing Company, 40-50 Market avenue, N. W., Grand Rapids, Mich. Complete details and prices on request.

SUGGESTIONS FOR THE FORD CAR OWNER.

Inspection of the Transmission Drum Unit and Finding the Degree of Wear of the Sleeves and Bushings—Removing the Flywheel and Magneto Field.

The 45th article dealing with the operation, construction, maintenance, care and repair of the model T Ford chassis, is the sixth of the series devoted to adjustment, restoration and overhauling.

THE hub of the driven gear of the transmission drum assembly is more than twice the width of the face, and is extended on one side only, this affording strength and insuring the correct relation of the three gears with the triple gears of the planetary gear-set. The length of the sleeves insures the relation of the reverse and slow speed gears, and when the driven gear is keyed on the inner or brake drum sleeve this has sufficient clearance of the slow speed sleeve so that it can turn freely, but this clearance is very small.

The bores of all of the sleeves are fitted with bronze bushings in which are grooves to insure distribution of oil on the transmission shaft and the sleeves. The sleeves are secured to the flanges or spiders carrying the drums by series of rivets that are countersunk so that the surfaces are clear. The forward or sleeve sides of the flanges of the brake and slow speed drums are faced smooth for a considerable area surrounding the sleeves and the rear sides of all three drum flanges are faced similarly, and there is a flanged bronze bushing fitted into the rear side of the brake drum flange.

Removing the Driven Gear.

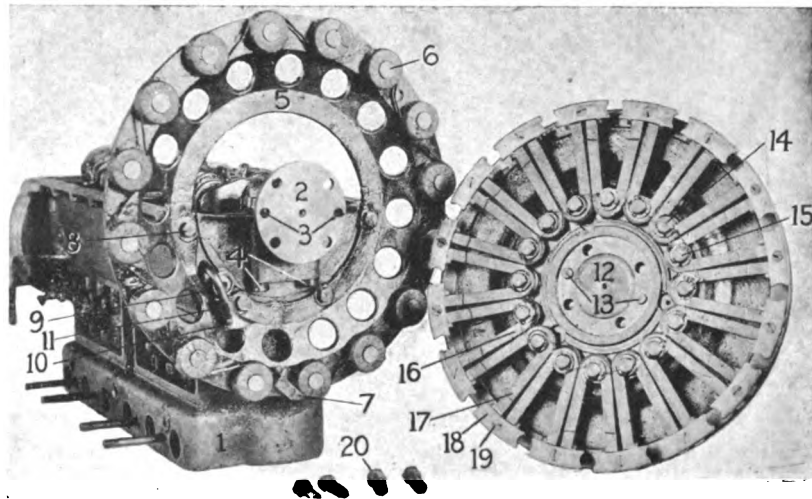
The removal of the driven gear from the brake drum sleeve is the first work that is necessary in disassembling the drum unit, and this can best be done by placing the unit on the bench with the driven gear uppermost. A puller is necessary to accomplish this, and a tool specially made by Ford Motor Company can be obtained. In event that such a puller is not obtainable, any jawed puller that will fit under the edges of the driven gear will serve, provided the length of the jaws is such that there is no undue strain upon the teeth of the gear.

In using the puller a nut or a circular piece of metal that will practically cover the end of the sleeve and its bushing and yet pass through the bore of the gear is necessary. This is seated on the end of the sleeve and the screw of the pul-

ler tightened. When the screw is turned down firmly a bar of metal can be placed between the nut and one of the legs of the puller so that there is sufficient leverage to prevent the assembly turning, and with a long wrench pressure can be applied to the screw of the puller. Two men can do this work to best advantage when time is a factor, but when a man is working alone the gear can be pulled by using a short bar as a lever between the nut or plunger on the end of the sleeve as is shown in the illustration. Care should be taken when the gear is being pulled that the nut or plunger does not contact with the bronze bushing so as to cut or damage it.

Two Keys Retain the Gear.

When the gear has been drawn from the sleeve the two keys, one on either side, will be ex-



Flywheel Removed from Crankshaft Flange, Showing Magneto Assembly.

- | | |
|--------------------------------------|------------------------------|
| 1—Cylinder Block. | 11—Oil Tube Clamp. |
| 2—Crankshaft Flange. | 12—Crankshaft Flange Seat. |
| 3—Flywheel Dowel Holes. | 13—Flywheel Dowels. |
| 4—Rear Main Bearing Retaining Bolts. | 14—Magneto Bolt. |
| 5—Magneto Field or Spool Support. | 15—Magneto Bolt Washer. |
| 6—Magneto Coils or Spools. | 16—Magneto Bolt Lock Wiring. |
| 7—Magneto Primary Contact Block. | 17—Magneto. |
| 8—Magneto Spool Support Screws. | 18—Magneto Clamp. |
| 9—Rear End of Camshaft. | 19—Magneto Clamp Screw. |
| 10—Oil Funnel and Tube. | 20—Flywheel Cap Screws. |

posed, and these can be taken out. The reverse and slow speed drums can then be lifted and the unit separated. Despite the best of lubrication the bushings will wear eventually, and if there is much side play the bushings should be renewed. The worn bushings can be forced from the sleeves by a press and the new forced into the sleeves by pressure. In the event that the brake drum flange and the bushing are considerably worn both had best be renewed. There is no economy in continuing the use of parts that

do not fit, which will be noisy, and with which lost motion will contribute to the wear of other parts of the assembly. The series of illustrations show the relations of the components of the unit to each other assembled and disassembled.

When the drum assembly has been removed from the transmission shaft the condition of the sleeve bushings with reference to each other should be determined by movement of the drums individually to learn whether or not there is play. Examination should also be made of the condition of the bushing of the brake drum sleeve and the transmission shaft. The better the fit the more satisfactory will be the operation of the gearset and the less noise will result. One should remember that the degree of wear with reference to any one sleeve may be small, but the aggregate may be considerable, and unless restoration is made the wearing from future use will be much more rapid.

The ideal condition is free movement of the

shafts, the sleeves and the bushings can be learned, and if there is such wear that reasonable relation cannot be restored by the use of new bushings, new shafts and sleeves should be obtained.

The bushings are cut with oil grooves, but other than these the surfaces of the bores of the bushings ought to be perfectly smooth and unscored. Scoring usually indicates lack of lubrication, and if the engine should be driven with a very low oil level for a brief period considerable damage might result. The shafts and sleeves, being harder metal, will not ordinarily show evidences of wear as quickly as the bronze bushings. In the event that the bushings are so worn that replacement is believed to be necessary, they must be taken out of the sleeves, and this can only be done with an arbor press, for the bushings are forced into the sleeves by heavy pressure, there being no keys or pins holding them in place. After the old bushings have been

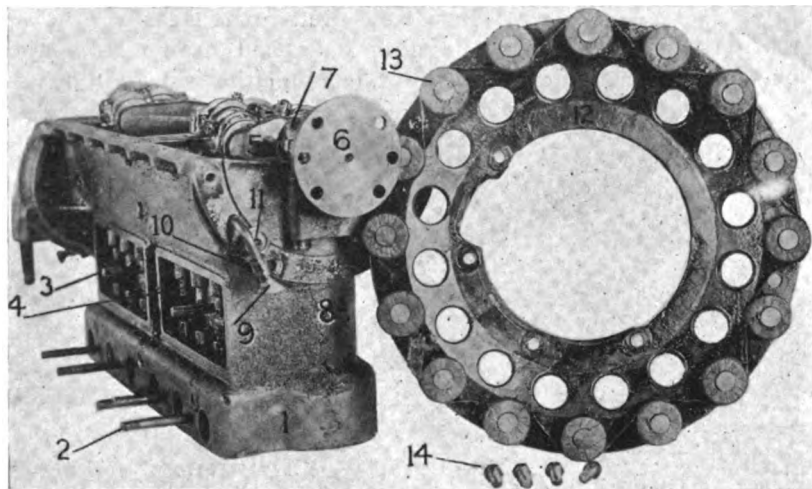
pressed out of the sleeves the new bushings are put into the sleeves with the same tool.

Triple Gears Riveted Together.

The triple gears are in reality three separate gears or pinions that are riveted together with eight rivets. There is little probability that the rivets of the gears should require attention, but when the gearset is assembled the gears should be withdrawn from the shafts and examined. The triple gear shafts are steel studs or stubs that are pressed into and pinned in holes in the flywheel and the pinions that revolve on them are bushed with bronze. Both the shafts and the bushings may be worn, and the condition of these can be fairly judged by trying them with the fingers after the gearset drums have been taken from the

transmission shaft. Generally there is not sufficient wear to justify replacement of the shafts, save with an engine that has been given very long service, but the bushings of the pinions may be worn, and very frequently are, to an extent that replacement is necessary. The old bushings must be removed and the new bushings pressed into the bores of the pinions with an arbor press. The faces of the pinions may be so worn that there is back lash or play and they are noisy. In this event new pinions are necessary.

The transmission shaft will not wear to such an extent that replacement is necessary as a rule, though there may be instances in old engines when this may be advisable, but ordinarily renewal of the brake drum sleeve bushing will be



Engine Block with the Flywheel and the Magneto Spool Support Removed.

- 1—Cylinder Block.
- 2—Manifold Stirrup Studs.
- 3—Valve Cover Plate Studs.
- 4—Valve Tappets.
- 5—Crankshaft.
- 6—Crankshaft Flange.
- 7—Rear Main Bearing.

- 8—Rear Main Bearing Bolts.
- 9—Oil Tube.
- 10—Oil Tube Clamp.
- 11—Camshaft Rear End.
- 12—Magneto Spool Support.
- 13—Magneto Coils or Spools.
- 14—Magneto Spool Support Screws.

sleeves without play. When the machine has been in use for a considerable period there is probability of wear of the transmission shaft and the sleeve bushings, and replacement of these may be desirable. A new transmission shaft may be necessary as well as a new bushing for the brake drum sleeve, and new bushings for the slow speed and the reverse drum sleeves, or possibly new bushings throughout will be sufficient. The exact diameters of the transmission shaft and of the bores of the bushings can be obtained from the Ford part books. The diameter dimensions of these parts are: Transmission shaft, one inch; transmission triple gear shafts, 11/16 inch; slow speed sleeve bushing 1 21/32 inches; reverse sleeve bushing, 2 5/16 inches. With these as standards and calipers the measurements of the

sufficient restoration. The very large area of the shaft and bushing is a very good insurance against wear.

Removing the Flywheel.

With the gearset drums and the triple pinions or gears removed, the transmission shaft and the triple gear shafts project from the back side of the flywheel. The next work is to remove the flywheel, and this is done by cutting the locking wire and removing four nuts that are seated against the crankshaft flange. These are reached from the front side of the flywheel and are in the centre within the circle of magnets bolted to the wheel.

These four bolts extend through the crankshaft flange, the flywheel and the flange of the transmission shaft, and when the nuts have been taken off the bolts can be drawn through the crankshaft flange and the flywheel, and the three units separated. Besides the four bolts, there are two dowel pins pressed into the flywheel, which fit into holes in the crankshaft flange, there being six holes in the crankshaft flange and four bolt holes in the flywheel, with the dowels fitted between the bolts. One will note that the arrangement of the bolts is somewhat unusual, in that they are equidistant from each other, 90 degrees apart, and that the dowels are 180 degrees apart.

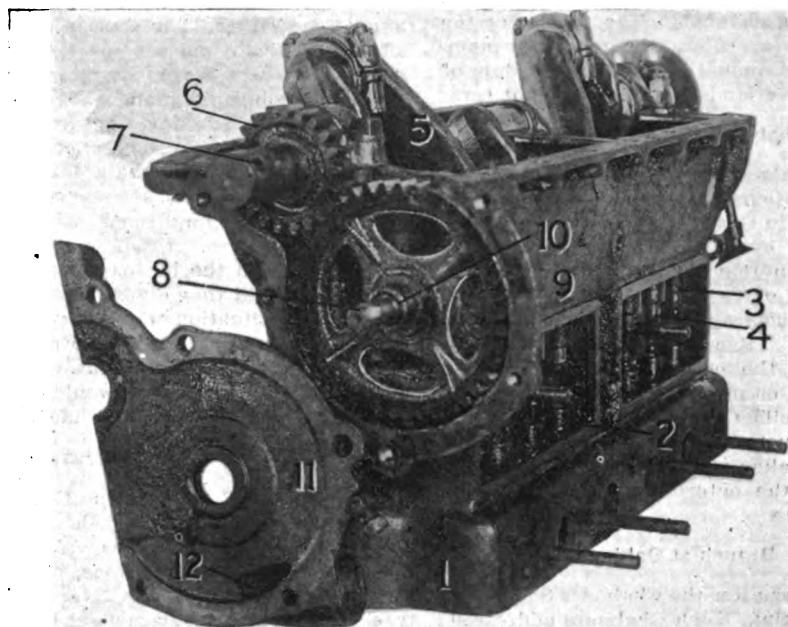
After the flywheel has been unbolted from the crankshaft and separated from the transmission shaft, the magneto field, or the "spool support," as it is referred to in the parts book, will remain attached to the engine block, as appears in the first illustration. This field is a pressed steel disc or ring, punched with a series of holes to lighten it. This is secured to the engine block by four cap screws that hold it in exact relation. Because of the design of the engine only the upper half of the field is secured to the block, the cap screws being arranged in a semi-circle that follows the arc of the ring.

The Magneto or Field Coil Support.

The cap screws are fitted with washers and the screws are secured with lock wiring to prevent them backing and loosening the field or spool support. One will note that on the right side of the engine when it is installed in the chassis a small section is cut from the internal diameter of the field ring. This is to give clearance for the rear end of the camshaft, which projects slightly through the bronze bearing in the

engine block, and for the funnel and rear end of the oil tube by which the lubricant is carried by gravity to the forward main bearing and timing gearset. One of the cap screws retaining the magneto field also carries the clamp which retains the funnel of the oil tube in exact position. In the accompanying illustration the oil tube will be noted. It extends through a hole or bore in the engine block to the forward end.

With the magneto field removed the engine block is so cleared that it can be handled very conveniently, either on a barrel or bench, but the crankshaft cannot be turned because the pistons normally at the highest point are above the head of the block. With blocks an inch thick at either end the crankshaft can be turned without obstruction when the engine block is inverted, but blocks at least four inches thick must be used when it is upright as in the chassis.



Engine Block with the Timing Gearset Case Cover Removed.

- | | |
|---------------------------------|---|
| 1—Cylinder Block. | 9—Camshaft Timing Gear. |
| 2—Valve Guides. | 10—Camshaft Timing Gear Lock Nut. |
| 3—Tappet Guides. | 11—Cylinder Front or Timing Gearset Case Cover. |
| 4—Valve Tappets. | 12—Inlet of Oil Filler to Timing Gearset. |
| 5—Crankshaft. | |
| 6—Crankshaft Timing Gear. | |
| 7—Crankshaft Starting Pin Hole. | |
| 8—Camshaft. | |

There are no points of wear on the magneto field or the oil tube. The matter of care of the magneto field will be taken up in connection with a consideration of the ignition and lighting system, which will be in subsequent articles.

The condition of the oil tube is very important. The oil is carried through it by gravity and any obstruction may so diminish the flow that the main bearings and timing gears may not be sufficiently lubricated. A possibility is the accumulation of fibre worn from the lining of the transmission gearset bands, or carried into the engine with the oil while filling it.

(To Be Continued.)

INDUSTRIAL NOTES AND COMMENT.

Overland Breaks Production Records—Chalmers to Build in California—King's Speedfest.

In a report submitted to President John N. Willys, it was shown that all previous production records of the Willys-Overland Company had been broken at the close of business March 31. The statement covered three months and revealed that 47,465 cars had been manufactured and shipped, which is within 1000 cars of equalling the production for the entire year of 1914. March was the biggest month, showing 19,780 cars shipped; in the corresponding month of 1914 production was 7005 cars, which indicates a gain of 12,775 cars. The Overland company has established a record in increasing output, for during the past 12 months it has been trebled through increased manufacturing facilities and marketing channels. The report for the first quarter shows the company maintaining an annual production schedule of 200,000 Overland and Willys-Knight cars.

Chalmers California Day.

More than 300 dealers and automobile salesmen journeyed to San Francisco on March 21 in Chalmers Six-40 touring cars furnished by L. H. Rose, Chalmers distributor in that city, to attend the big gathering of California dealers held under the auspices of the Chalmers Motor Company. San Francisco papers referred to the occasion as the greatest gathering of master salesmen ever held on the Pacific Coast. A luncheon at noon and banquet at night, presided over by Hugh Chalmers, were outstanding features of the entertainment part of the programme.

Branch at Oakland.

Two days after the Chalmers San Francisco meeting, Hugh Chalmers addressed the Oakland Chamber of Commerce, that body reporting that he announced that

he had definitely decided upon Oakland as the location of a big assembling plant and factory for light manufacturing. The Chamber reports his address in part as follows: "The plant will be a modern, up-to-the-minute assembling headquarters. At the start from 300 to 400 men will be employed and the capacity will be 25 to 30 cars a day. We will take care of all the Chalmers business on the Pacific Coast, which we now estimate at from 7000 to 8000 cars a year."

King's Third Speedfest.

About 350 automobile men, representing parts manufacturers, were guests of the King Motor Car Company at Hotel Statler, Detroit, at the company's third annual "speedfest." It was an informal affair, practically no set speeches being made. Artemas Ward, Jr., president of the King company, made the only address of the evening, he expressing thanks for the part they have had in making the King Eight the great success it is and offering the assistance of his company in helping them solve their present difficulties. From the talk circulated between the big parts makers it was evident that they did not expect that the material situation would become any easier in the immediate future, some even predicting that practically every large manufacturer of cars would have to add to the list price of their models.

Celebrates 50th Anniversary.

The Merchant & Evans Company, which manufactures and deals in Hele-Shaw clutches, rear axles, alignment joints, jackshaft transmissions, phosphor bronze bushings, complete Evans motor trucks and tractors and several kinds of automobile parts and specialties, recently celebrated its 50th anniversary by

erecting a large office building and a warehouse on property adjoining the main factory at Philadelphia. This company was founded in 1866 by Lieutenant Commander Clark Merchant and is now headed by Powell Evans, a man widely known in all parts of the country as chairman of the National Hardware Association. The company has two other factories, in Wheeling, W. Va., and Chicago, and offices in practically every large city in the country.

Splitdorf in California.

It is announced by the Splitdorf Electrical Company, maker of Splitdorf ignition systems, that a branch and service station has been opened at 3040 Broadway, Oakland, Cal.

Paige's Citizenship Bureau.

The Paige-Detroit Motor Car Company is extending aid to its foreign born employees in securing their citizenship papers. For the purpose the company has established a Citizenship Bureau, placing it in charge of F. L. Jewett, assistant to the president, and W. A. Wheeler, production manager. In the past a great many of the employees have been deterred from taking this important step through dread of going through the necessary formalities without friendly assistance.

Preparedness Among Makers.

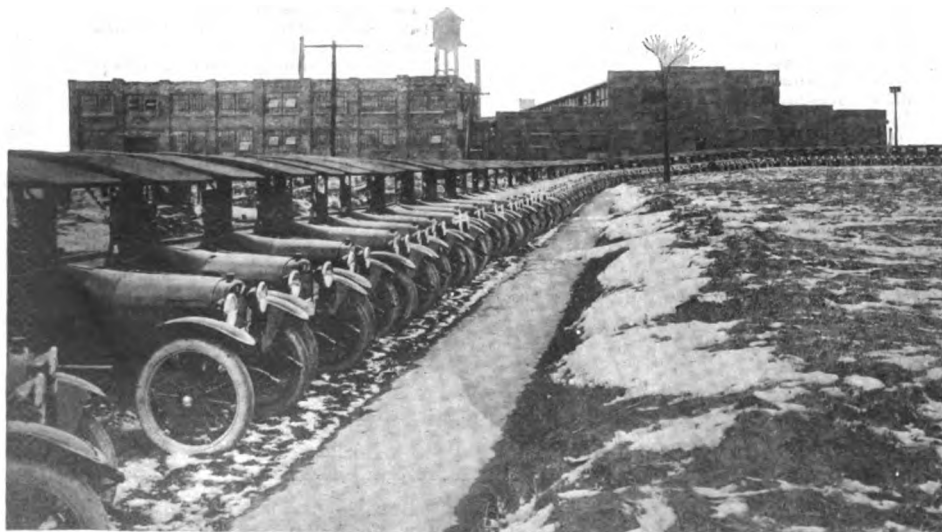
The Findeisen & Kropf Manufacturing Company, maker of the Rayfield carburetor, has been experiencing record-breaking sales within the past few months. The company ascribes the cause not only to the merits of its product, but the high price of gasoline. The Rayfield makers are well provided to take care of the demand, having a large stock of materials on hand, and because they have ownership of their own smelter and foundry and have large and capable tool and pattern departments.

Another Puritan Banquet.

The Puritan Machine Company, Detroit, Mich., held another of its interesting banquets to its department heads and during the session the plan of issuing identification cards to all Detroit garage men was discussed. The cards would be issued serially to each garage man, who will then be registered with the company and be entitled to a discount on all repair and accessory parts. The company does this to protect itself against infringement by persons who are not entitled to the consideration, and hopes to see the plan adopted by garage men in all parts of the country.

Car Assembly Contests.

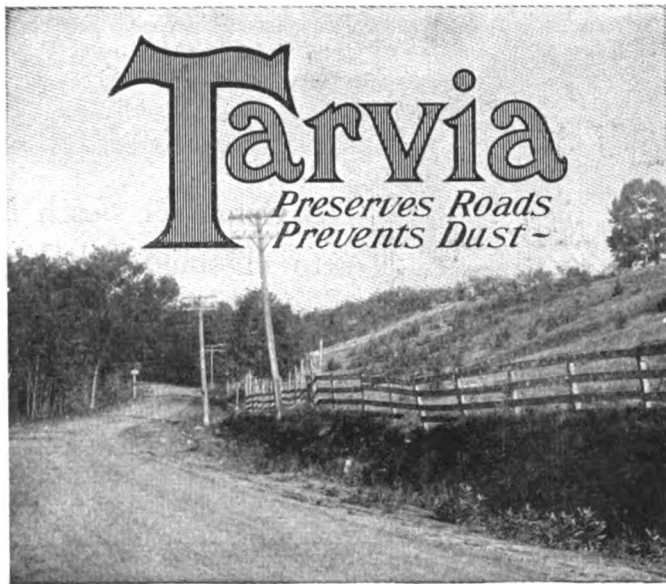
Buick and Oldsmobile agencies in San Francisco, Cal., have inaugurated a series of contests in which workmen from the respective concerns compete in assembling Buick and Oldsmobile cars. The first was staged at a local theatre, and each crew consisted of six men. The Oldsmobile team won, assembling a four-cylinder car, which had been thoroughly "knocked down," in two minutes flat. The Buick team finished 21 seconds later.



The Biggest "Drive-Away Day" Ever Held in Indiana Was Staged by the Inter-State Motor Company of Muncie on March 16, When 180 Dealers and Spring Buyers from Ohio and Indiana Drove to Their Respective Homes 150 Inter-State Cars.

How did *your* roads come through the winter?

ARE your macadam roads frost-proof? Are they in good condition this Spring? Or are you now going through a season of dirt and mud "while the frost is coming out". In a typical American township today are these examples of "spring" roads.



Notice the clean, smooth, dustless Tarvia surface.

Case 1. Old plain macadam

Worn down by automobiles, exposing the uneven basic mosaic which has caught water and suffered severely from disruption by frost. Considerable loose stone. Mud now—dust later. No relief till warm weather, when expensive resurfacing will be in order. Deterioration is 40%.

Case 2. New macadam last year

Still a good road, but with a one-inch film of mud in wet weather and dust in dry. The smooth "roof" of the road is being destroyed. Already the road fails to shed water promptly, although the foundation is still intact. Deterioration 15%.

Case 3. Old macadam street treated with oil to suppress dust

Effect of the oiling has worn off. Plenty of dust now, or slimy black mud. Deterioration going on steadily because the oil had no bonding or dust-preventing power—it merely made the dust too heavy to blow. No relief in sight. After mud dries dust must blow till weather is warm enough for re-oiling. Can't even sprinkle with water on account of the old oil.

The foregoing represents the result of old and wasteful methods of road construction. We will now tell you of results where newer and more economical methods were used.

Case 4. Old macadam treated last year with a coat of "Tarvia-B"

Applied from a sprinkling cart, the Tarvia soaked into the surface, forming a sort of tough tar-concrete. Sheds water like a duck. No mud or dust. No deterioration. Looks as good as it was last Fall. Needs only light renewals of "Tarvia-B" to make it better than ever.

Case 5. New macadam built with heavy "Tarvia-X"

Constructed layer by layer three years ago. The Tarvia cements the stone together in a traffic resisting layer. It added slightly to the original cost, but saved much stone and labor. Clean, dry and smooth. If it shows any wear a light coat of "Tarvia-B" restores it to prime condition.

Tarvia makes macadam frost-proof, winter-proof and automobile-proof. It is a tough, dense, viscid binder, a plastic cement that defies water, weather and traffic.

Expense? Tarvia adds a little at the beginning and saves a lot in the end on the obvious principle that it is cheaper to have a road that will easily withstand modern traffic than to keep on renewing an inferior type of surface that is too weak for the traffic.

A road that pulverizes and abrades under the attrition of the backward kick of the automobile driving-wheels is an expensive nuisance nowadays. That is why the plain macadam road is disappearing.

Durable, dustless tarvia-bonded roads really cost less than dusty, water-bonded macadam roads, owing to their longer life and lower maintenance costs.

There is a Tarvia process for most road problems.

Special Service Department

This company has a corps of trained engineers and chemists who have given years of study to modern road problems.

The advice of these men may be had for the asking by anyone interested.

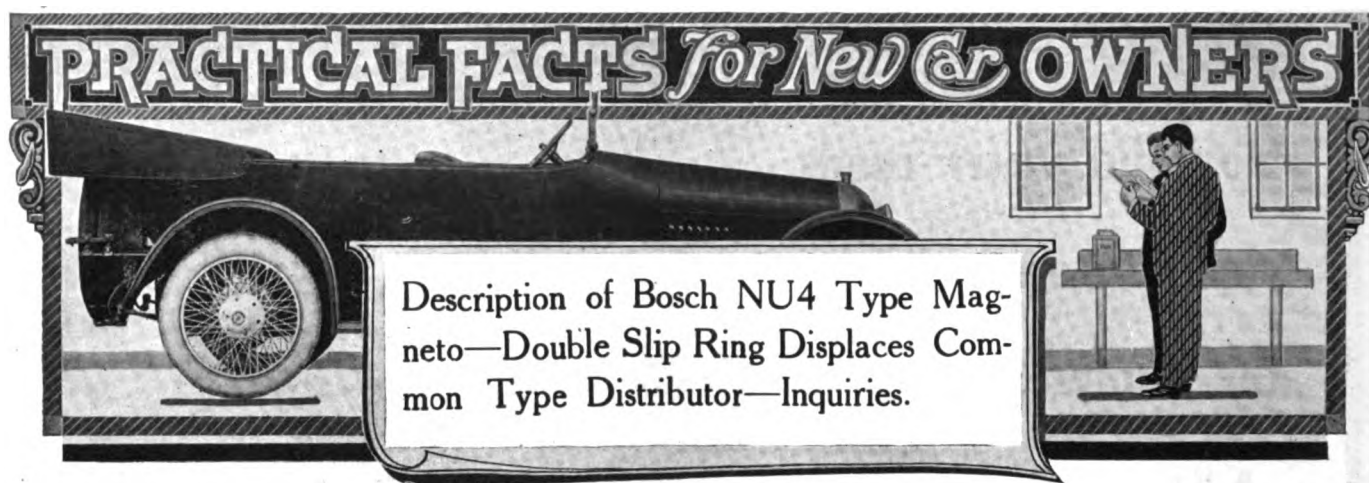
If you will write to the nearest office regarding road problems and conditions in your vicinity, the matter will have prompt attention.

Illustrated booklet at request.

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IN THIS installment the magneto under discussion is the Bosch NU4 type, the construction of which is radically different from any that have been described in the previous

according to the firing order of the motor.

The method of timing this magneto is a departure from that of any yet described. It was stated that the metal segments were diametrically opposite. This arrangement would cause one brush to make a contact and produce a spark in that cylinder ready to fire. The opposite segment would be in contact with the brush corresponding to the cylinder that is exhausting. Thus it will be seen that two sparks are produced at each half revolution of the armature shaft and that only one of these is used for ignition purposes.

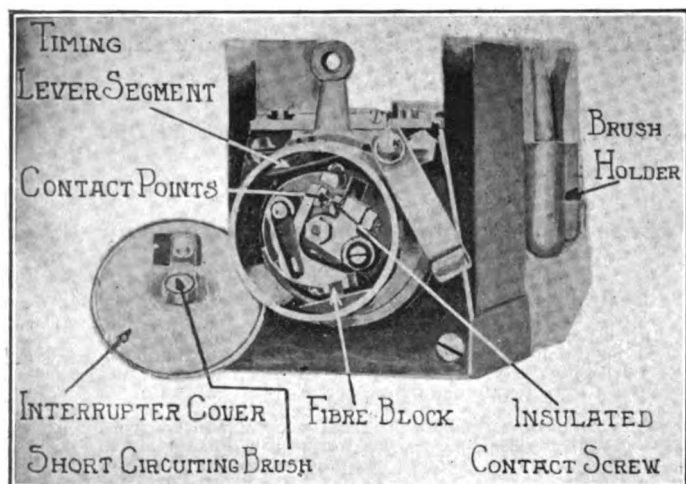
Effect of Surplus Spark.

It is quite natural for the reader to wonder as to the effect the surplus spark has on the operation of the motor. It has absolutely none, because it occurs in the cylinder which is engaged in the expulsion of the burned gases.

Replacing the usual type of distributor plate with its terminals, are two brush holders which fit directly into openings in each side of the driving shaft end plate. In the wiring diagram herewith the brushes which receive simultaneous contact have been marked by the figures 1 and 2. Those indicated by figure 1 constitute one pair, and those marked 2 the pair which receive contact at the same time.

Firing Order in Four-Cylinder Motors.

For reasons which have been published in these columns from time to time, four-cylinder motors are designed to fire either in the order of 1-2-4-3 or 1-3-4-2. The difference between the firing orders is that in the former the third cylinder is exhausting when the first is firing, while in the second arrangement the second cylinder is exhausting when the first is firing.



Showing Breaker Cover Removed from the Bosch NU4 Type Magneto.

issues. It will be recalled that the general practise has been to locate the distributor above the armature shaft and to utilize reduction gears so that it could be driven at half the speed of the armature shaft.

The Bosch type NU4 magneto is a true high-tension instrument designed for use with four-cylinder, four-cycle motors of moderate dimensions. Statement is made, however, that its output of current is sufficient for all general requirements.

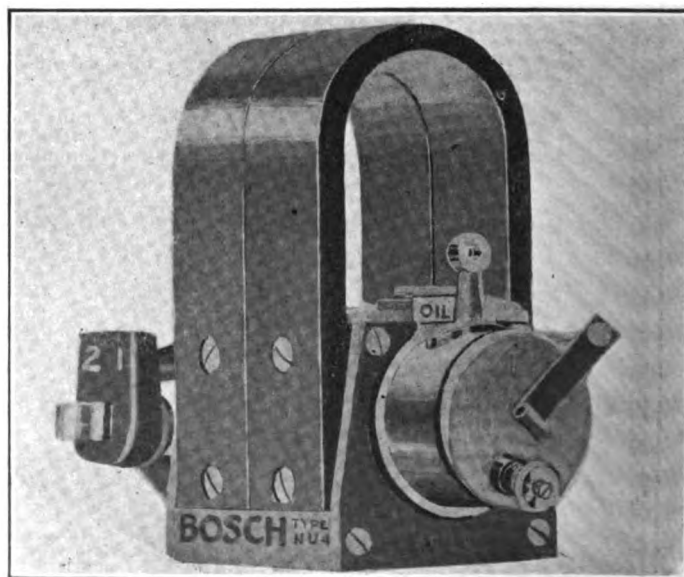
An Unusual Type of Distributor.

Perhaps the most striking feature of this magneto is the elimination of the usual type of distributor and armature gear. These members have been replaced by a novel and ingenious construction for the distributing of high potential current to the spark plugs in the cylinders. The design includes a slip ring arrangement which is mounted on the end of the armature shaft and which revolves with it at crankshaft speed.

The slip ring is of one piece construction, but there are two grooves cut in the hard rubber insulation and imbedded in the base of each is a metal segment which is flush with the lower surface of the groove. There are two segments placed diametrically opposite, or 180 degrees apart. These are insulated from each other as well as from the metal of the frame, armature core, etc.

Carbon Brushes Collect Current.

In the accompanying illustration is shown the manner of collecting the current. The high-tension current is gathered by four carbon brushes, which are arranged as indicated. These brushes are in direct communication with the cables that carry the current to the spark plugs and are arranged



The Bosch NU4 Type Magneto is a True High-Tension Instrument in Which the Conventional Distributor is Replaced by a Double Slip Ring Driven at Crankshaft Speed.

The table shown herewith gives the sequence of strokes with both firing orders and is of value for studying the timing and fittings of the cables so that the surplus spark always occurs in the cylinder which is exhausting.

FIRING ORDER, 1-2-4-3.

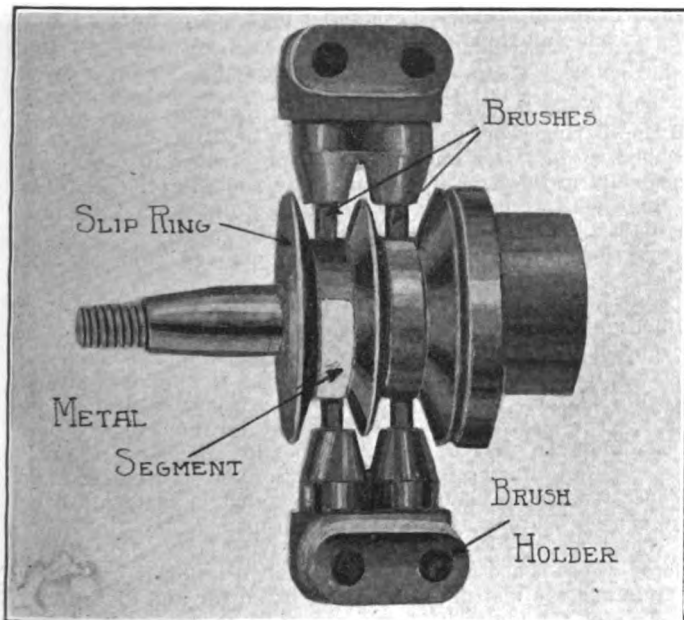
Cylinder 1	Cylinder 2	Cylinder 3	Cylinder 4
1—Firing	Compression	Exhaust	Suction
2—Exhaust	Firing	Suction	Compression
3—Suction	Exhaust	Compression	Firing
4—Compression	Suction	Firing	Exhaust

FIRING ORDER, 1-3-4-2

Cylinder 1	Cylinder 2	Cylinder 3	Cylinder 4
1—Firing	Exhaust	Compression	Suction
2—Exhaust	Suction	Firing	Compression
3—Suction	Compression	Exhaust	Firing
4—Compression	Firing	Suction	Exhaust

Two Sparks at Each Revolution.

In the NU4 type Bosch magneto the two sparks utilized for ignition purposes are produced at each revolution of the armature shaft. This is necessary, as the instrument is driven at crankshaft speed. As this instrument is of the true high-tension type, the armature is provided with two windings, a coarse primary and a fine secondary. The primary winding is connected at one end to the armature core, while the other



Construction of Double Slip Ring Having Metal Segments Placed 180 Degrees Apart.

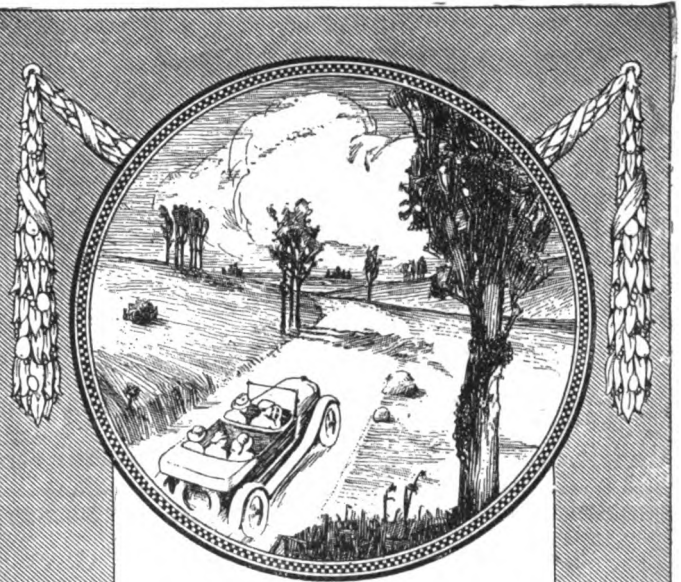
is attached to the insulated contact block carrying the long or adjustable contact screw.

The interrupter lever which carries the fixed platinum contact screw is mounted on the interrupter disc. Whenever the two contact points are together the primary circuit is completed; it is broken when they separate. The parting of the points causes a high-tension current to be induced in the secondary winding. The spark at the plugs takes place upon the interruption of the primary circuit. The breaker mechanism revolves with the armature shaft and the break of the points is obtained by the use of two metal segments integral with the circuit breaker housing.

Windings Insulated from Each Other.

In the NU4 type magneto the primary and secondary windings are distinctly separate, and each is insulated from the other. The two ends of the secondary circuit are connected to the two metal segments of the slip ring. It was previously explained that the slip ring of which the metal segments are a part, rotates with the armature shaft.

The timing of the magneto now under discussion is simple. Turn the engine over by hand until the piston of the No. 1 cylinder is at top dead centre, or in other words, at the completion of the compression stroke. If the flywheel is not



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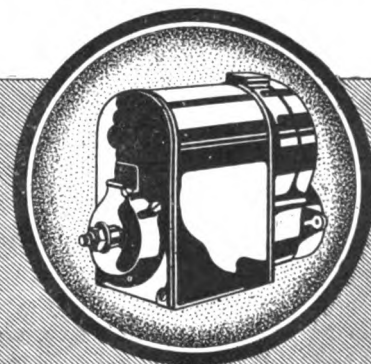
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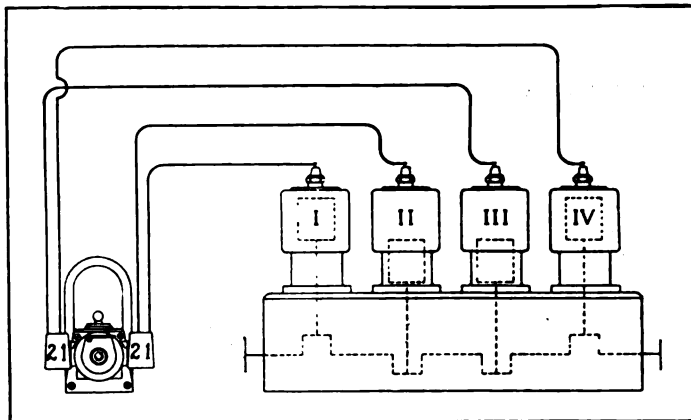
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Wiring Diagram of the Bosch NU4 Type Magneto.

marked, any of the several methods described in previous issues may be adapted for the purpose.

When the piston is properly located in the cylinder, rotate the armature shaft of the magneto until the metal segments of the slip ring contact with the brush marked I in each of the brush holders. The operation is completed by connecting one of the brushes, indicated by the numeral I, with the first cylinder of the motor and the other with the fourth cylinder. The remaining brushes, designated by 2, are connected with the second and third cylinders.

Brush Holder Easily Removed.

The brush holders fit directly into openings in each side of the driving shaft end plate and are held in place by an L shaped spring. One end of this spring pivots into a slot cut vertically in the side of the end plate and the other end has a small boss which, when the spring is in its normal position, rests in a recess in the brush holder. By merely pushing the spring downward the holder can be removed from the end plate.

A feature worthy of special mention is the manner in which the cables leading to the spark plugs are retained. The insulation is removed from the end of the cable and the bared section inserted through the opening of the holder until it reaches bottom. A small screw is then inserted and set up tight. This screw passes between the strands of wire and locks them so that a perfect connection is made and one which is not affected by motor vibration, oil or weather. The proper tension to insure a perfect contact is maintained on the carbon brushes by light spiral springs.

The type NU4 Bosch magneto is particularly adapted to a motor where space is limited. The construction is extremely simple and the instrument is easily cared for and cleaned.

To stop the motor it is only necessary to ground the primary current, which is collected by a brush in the cover of the circuit breaker housing, delivered to a terminal and then to some metal part of the chassis. This arrangement diverts the primary current and prevents it from being intensified.

The Correspondence Department.

**The Advantages and Disadvantages of
 Steam Car, Correct Timing for Model T Pope-
 Hartford Motor, Why Goodrich Tires Are
 Black, Table of Inflation Pressures.**

QUALITIES OF STEAM CAR.

(G. F. H., Chicago, Ill.)

There has been much dispute among the chauffeurs in this vicinity relative to the advantages which a steam car has over a gasoline type. If you have the space will you publish your unbiased opinion concerning the subject?

The chief advantage claimed for the steam car is flexibility, because it is controlled wholly by opening or closing the throttle. In this way more or less steam is supplied and, of course, the power is proportionate. When climbing a very

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steep grade, no gear reduction is necessary. By simply opening the throttle a little wider, more steam and consequently greater power is produced. The steam engine being designed to start under load by merely applying the power, eliminates the clutch and transmission common to the gasoline car. The engine is coupled directly to the rear axle.

A disadvantage of the steam engine is that it is necessary to generate the steam before the car can be started. This requires time. Large quantities of water must also be carried and it must be frequently replenished when on the road. Constant attention must also be afforded the fuel and water pumps. Another notable disadvantage of the steam car is that a naked flame is required to boil the water for the producing of steam. Wherever there is a naked flame, there is danger of fire.

TIMING POPE-HARTFORD MOTOR.
(E. L. B., Oneonta N. Y.)

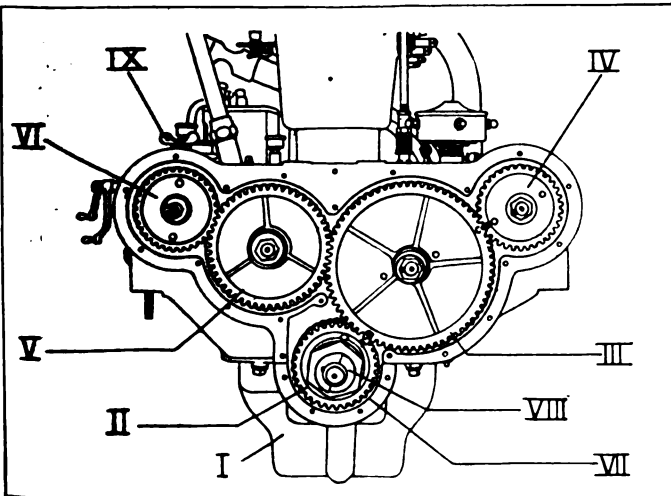
I have been taking your journal for the last two years and find it a big help in many ways. I have a Pope-Hartford motor in my car, model T, 1909, which I have rebuilt. The cylinders have been rebored from 4 5/16 to 4 3/4 inches. It has a 5 1/2-inch stroke and racing pistons. It also has a new crankshaft and connecting rod bearings. Now what I wish to know is how to time the valves to get the most speed possible?

There is only one way of setting these valves and this is controlled by the timing gears. All model T engines have the timing gears marked as shown in the accompanying illustration: Crankshaft gear space, A; camshaft gear tooth, B; space, C, and the magneto driving gear tooth, D. When these gears are properly meshed, space A on the crankshaft gear should mesh with tooth B on the camshaft gear. Space C on the camshaft gear should mesh with tooth D on the magneto driving gear.

The exhaust valve should open 35 degrees, or .37 of an inch, before lower centre and close on top centre. The inlet valve opens at 10 degrees, or 3/64 of an inch past top centre, and closes at 30 degrees, or .27 of an inch, past lower centre. The engine should be set to fire with the piston about one inch down from top centre on the ignition cycle, with the spark fully retarded when using battery ignition only. With magneto ignition the position of the piston should be 1/2 of an inch down from top centre on the ignition cycle with the spark lever fully retarded. There should also be 1/32 of an inch clearance between the valve stem and the rocker arm when the valve is closed.

To determine that the valve is properly set, put a piece of thin, tough paper between the top of the exhaust valve stem and the valve operating lever. Turn the flywheel slowly until the exhaust valve opens and closes sufficiently to allow the paper to be drawn without tearing.

Then remove the inlet valve of the same cylinder. Pass a rod about 1/4 inch diameter and 18 inches long down through



Showing Timing Gears of Model T, Pope-Hartford Motor—I, Crank Case Bottom Cover; II, Crankshaft Gear; III, Camshaft Gear; IV, Magneto Driving Gear; V, Water Pump Idler Gear; VI, Water Pump Driving Gear; VII, Lower Section Gear Case Cover; VIII, Starting Ratchet; IX, Gear Case Oil Hole Plug.

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until the end rests on the top of the piston. On this rod make a mark even with the top of the cylinder. Turn the flywheel slowly in the same direction as before and the piston should only rise 1/32 of an inch more to prove that the valve is set correctly. If it is not properly set, the easiest way to correct it is to remove the brass idler gear in the aluminum case in front and turn the camshaft gear one or more teeth until the exhaust valve closes as above described.

When one exhaust valve is correctly set, all other valves, both inlet and exhaust, will be correctly timed.

If a greater speed is desired, it should be obtained by changing the gear ratios and not by attempting to alter the timing of the motor.

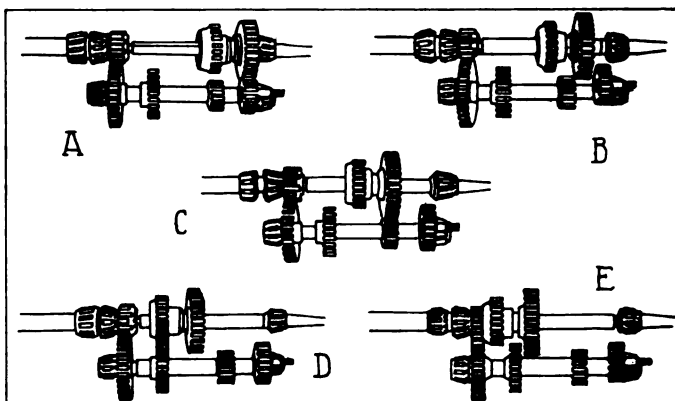
OPERATION OF PROGRESSIVE TRANSMISSION.

(G. G., Augusta, Me.)

Being a subscriber to your magazine, I would like you to explain the operation of the progressive type of transmission. Starting from neutral, is it necessary to engage every gear before high can be reached?

The progressive type of transmission is as the name would indicate, one which advances the gear ratios only in the order of their rotation. If the gear shifting lever was in the neutral position it would be impossible to engage the high speed without engaging the low and intermediate speed gears first. This is often referred to as running through the gears.

In this type of transmission there are three shafts, the clutch shaft which extends through the front of the case and on the outer end of which is mounted the clutch; the main shaft which is in line with the clutch shaft and which extends through the rear of the case and transmits the power



Arrangement of Gears in Progressive Transmission; A, Reverse Gear Meshed; B, Gears in Neutral Position; C, Low Gear Engaged; D, Intermediate Gear Meshed; E, High Gear Affords Direct Drive from Engine.

to the drive shaft; and the counter shaft, which is usually located below the main shaft. The speed reductions are made by the different sizes of gears which are firmly attached to the counter shaft. On the square main shaft are two gears of different size, which are slid along by the action of the gear shifting lever.

The power from the engine is transmitted through the clutch shaft to the first gear on the counter shaft. The gear on the clutch shaft and the first gear on the counter shaft are always in mesh and are therefore termed the permanently meshed gears. From the counter shaft the power is transmitted through the sliding gears to the main or square shaft. From this shaft the power is transmitted through the driving shaft to the rear axle and to the wheels. When the car is travelling in high speed the main shaft is coupled directly to the clutch shaft. This is accomplished by an internal gear in the sliding assembly meshing with the gear attached to the clutch shaft. Although the counter shaft is in mesh and turning, no power is transmitted through it.

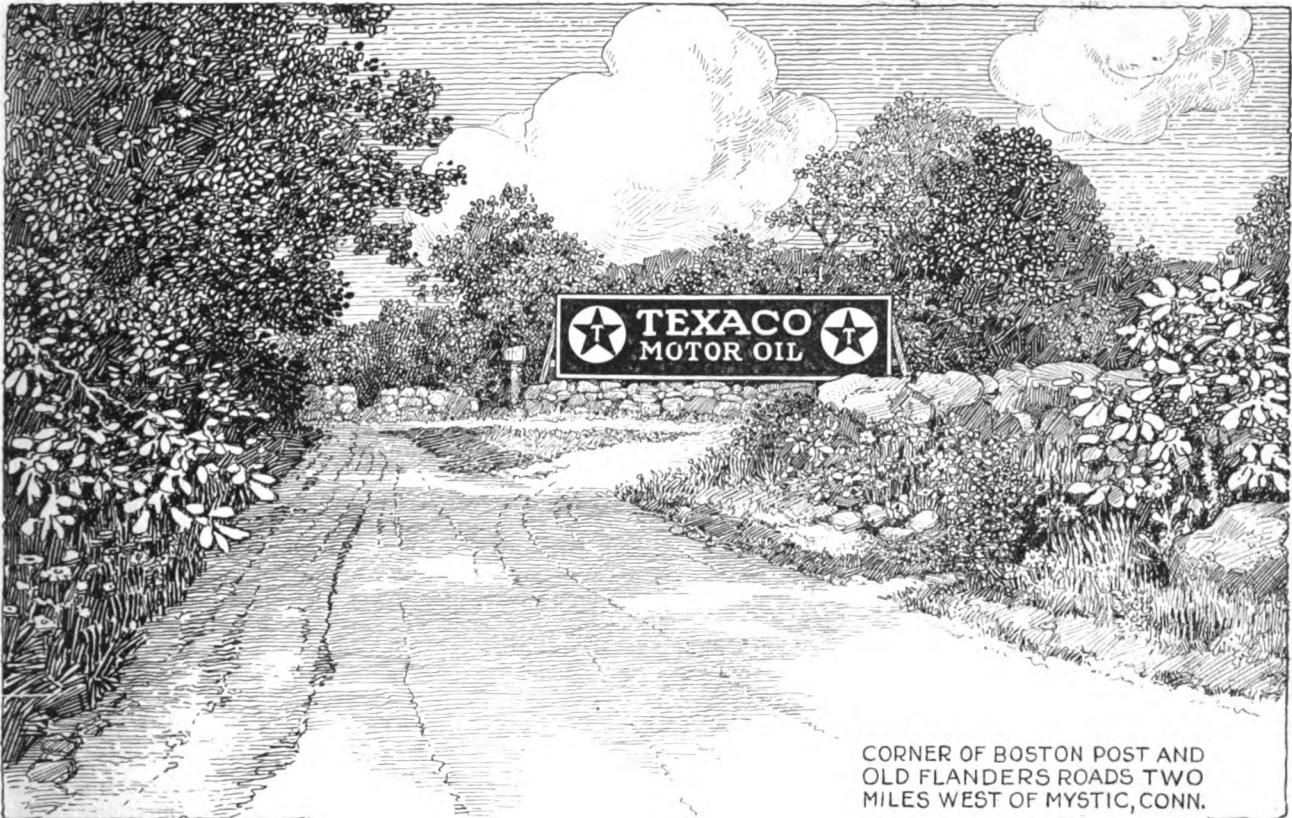
The accompanying illustration shows the positions of the gears for producing the different speeds.

WHY GOODRICH TIRES ARE BLACK.

(H. R. W., Tampa, Fla.)

Has the color anything to do with the quality of the rubber used for tire treads? Why is it that a certain Goodrich tire has a black tread?

(When Writing to Advertisers, Please Mention The Automobile Journal.)



Crude rubber is a dark brown or amber color, which is not especially attractive. It has, therefore, been the custom of many manufacturers to change it. Because of the war there is a shortage of dyestuffs and consequently there is not so much coloring now done.

The reason for the Goodrich black safety tread is answered in the March issue of the Goodrich, a house organ of B. F. Goodrich Company's. It states that the tire is black for the same reason that salt is white. It further explains that an experiment was made to produce the toughest rubber possible and that the color naturally came black. We do not know the formula used to produce this rubber, so cannot supply further details.

CARE OF ELECTRIC HORN.

(W. F. M., Philadelphia, Penn.)

Kindly give me full instructions for cleaning and lubricating my Klaxon electric horn and Stewart speedometer.

The Klaxon electric horn is designed to operate in connection with a six or eight-volt storage battery, or six or eight dry cells. At different times test the battery to determine that the horn is being supplied with the proper amount of current. The volt meter should register not less than 5.5 volts. Once a week two drops of cylinder oil should be dropped into the oiler on the back of the horn. Once every month clean and lubricate the commutator, which can be reached by removing the four screws in the bottom of the motor case and taking off the cover. The accompanying illustration, A, shows the commutator after the bottom of the motor case has been removed. With a dry cloth wipe it clean, after which apply a little vasoline to a clean part of the cloth and smear a slight film, as shown at B. If regularly cleaned and lubricated, the Klaxon will operate indefinitely without adjustment.

Under no condition should you attempt to lubricate the speedometer head, as any parts requiring lubrication were attended to when the instrument was assembled. The manufacturer of this instrument furnishes a special lubricant for the shaft. This is to be placed in boiling water, so that it

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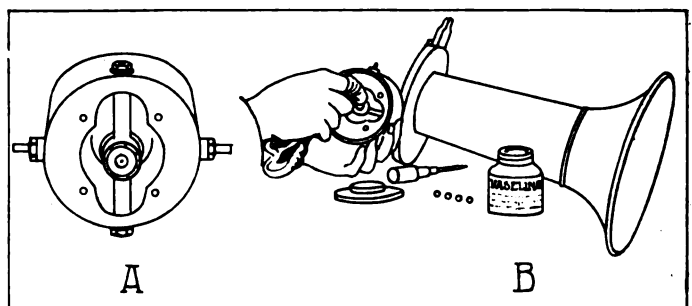
will be soft enough to run. The shaft should then be held in a vertical position, and the oil poured in. When cool, it forms a plastic cushion of soft grease around the chain, insuring quiet and frictionless operation.

The swivel joint should be lubricated once a week. A grease cup is provided and should be filled with hard grease. Each day a turn should be given to the grease cup so as to force its contents into the joint. Unless this precaution is taken, swivel joint trouble is inevitable.

TRUCK DIFFERENTIAL.

(M. F. Y., Burlington, Vt.)

What mechanism replaces the differential in a truck which



A. Cover Removed, Disclosing Commutator of Klaxon Electric Horn; B. Smear Commutator with Slight Film of Vaseline.

has a dead rear axle? In pleasure cars I notice that the rear axle assembly includes the differential mechanism. I do not understand how a truck could be operated around a corner without some form of differential.

Every type of motor vehicle, whether it be adapted for pleasure or commercial purposes, must use some kind of differential. In the chain driven trucks the equalizing gears are incorporated in the jackshaft housing. The construction and operation of this assembly is exactly the same as that used in the pleasure car. When turning a corner the action of the differential causes the outside jackshaft sprocket to turn



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faster than the inside. The sprockets are, of course, in direct communication with the rear wheels, chains being used for this purpose.

HIS FORD CLUTCH SLIPS. (G. D. A., Foxboro, Mass.)

Having subscribed to The Automobile Journal at the recent Boston show, I would like to take advantage of the Reader's Department. I have a model T 1913 Ford car. Recently I have noticed that when climbing grades the motor has a tendency to race, but does not transmit the power to the rear wheels. To the contrary, the speed of the car is decreased.

No doubt the cause of your trouble is that the high speed clutch slips. The adjustment is simple and can be made at home without the services of a professional mechanic. With the motor inoperative and the emergency lever moved forward to its maximum position, remove the front floorboard and transmission cover and the working mechanism will be exposed, as shown in the accompanying illustration. Directly in front of the clutch spring you will see three clutch fingers. Each has a cotter pin extending through it, and a set screw. By removing these pins the set screws will be unlocked. Give each screw about a half turn and then replace the cotter pins and test the action of the clutch. If it still has a tendency to slip under load, give the screws another half turn. It is important that each set screw be given the same number of turns to insure the proper clutch action. Be sure to spread the ends of the cotter pins so that they cannot work out.

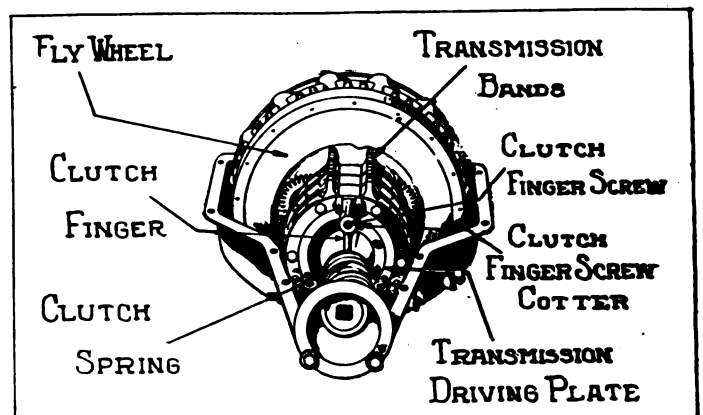
MIXING ETHER WITH GASOLINE. (J. W. L., Bridgeport, Conn.)

Is it advisable to mix ether with gasoline so that a richer mixture may be obtained and if so, what proportions are used? Will this mixture injure the motor? Is there any danger of an explosion when mixing the two? Can kerosene be mixed with gasoline in equal proportions to produce a satisfactory operating condition?

Would not advise the mixing of fuels, either ether with gasoline to make the latter more explosive, or kerosene with gasoline for the sake of economy. The former mixture is objectionable, being both unsatisfactory and dangerous, while the latter, when the ordinary carburetor is used, will form a fluid having a high vaporizing point and thus actually deteriorate the volatile liquid, gasoline.

Ether is an oxygen carrier, this being the reason for it being suggested by many as an agent which will increase the value of gasoline as a fuel. With the modern heated carburetor, gasoline alone, even though it be of a low grade, should afford satisfactory engine operation. The high price of ether must also be considered. Since the combining of fuels is very seldom done, there is no rule on record for the mixing of the two.

To a certain extent, ether, oxygen, picric acid and other similar oxygen carriers injure the engine by subjecting bearings, crankshafts, cranks and other moving parts to unusual strains for which they were not designed. Picric acid is also said to form a deposit on the cylinder walls, which attacks the glaze and eats into the metal. It is not unlikely that if either



View of the Working Mechanism of Ford Transmission with Front Floorboard and Transmission Cover Removed.

(When Writing to Advertisers, Please Mention The Automobile Journal.)

ether or picric acid were used, they would cause trouble at the valves by attacking the seats.

There is no danger of spontaneous combustion when combining the fluids mentioned, but because of the higher explosive nature of the compound fuel, naked flames must not be tolerated near it.

TABLE OF TIRE INFLATION PRESSURES.

(G. T., Greenfield, Mass.)

I have a tire inflation table which was published some years ago by the Goodyear Tire & Rubber Company. I hear that they have conducted several tests and have recently issued a new table. If you know what this is, will you kindly publish it in the next issue of the Automobile Journal?

Because of the large number of inquiries on hand and limited space, it was necessary to delay your answer. All correspondence is answered in the order received.

You no doubt have a table of inflation pressures which was published a few years ago by the Goodyear Company. At that time the figures were correct, but at the present the weights of cars, etc., have so changed as to make them inadequate. Recently the Goodyear experimental men conducted a thorough investigation into the matter and the following table is the result of their work:

Gross Carrying Capacity of Goodyear Tires							
Infl. Press.			Tire Section Diameter				
Cord Fabric	3"	3½"	4"	4½"	5"	5½"	6"
27	30	250					
32	35	290	360				
36	40	335	410	500			
41	45	375	460	560	675		
45	50	415	515	625	750	875	1000
50	55	460	565	690	825	960	1100
54	60	500	615	750	900	1050	1200
58	65		670	815	975	1135	1300
63	70		720	875	1050	1225	1400
68	75			940	1125	1310	1500
72	80		1000		1200	1400	1600
77	85				1275	1485	1700
81	90				1350	1570	1800
86	95					1660	1900
90	100						2000

Before Pressure Drops 20% Tire Should Be Reinflated.

This table is worthy of careful study and preservation because by following it, additional tire service is certain to be obtained.

WANTS TO KNOW CAUSE OF BACKFIRE.

(E. B., Meriden, Conn.)

Believing that it is the custom for you to help motorists, I would like you to solve the cause of my trouble. I have a 1909 ——— runabout. It has a twin cylinder opposed motor of about 12 horsepower. For some time past there has been a blowing back through the carburetor at high engine speeds. What would you suggest was the cause of this?

There are several possible causes of backfiring and only by a systematic search can the source be determined. The most common cause is delayed combustion due to either poor ignition or defective mixture. Would suggest that you first inspect the ignition system, giving attention to the following points in order mentioned:

Test the battery and ascertain that it is of the proper strength. Examine the timer and determine that it is not wobbly and that every contact is made in a positive manner. Next trace the wiring for worn insulation and to see if all terminals are securely fastened.

Next in order requiring attention is the spark plugs. See that the porcelains are not cracked and that the contact points are the proper distance apart. If the ignition system is found to be all right, examine the timing of the valves. One or more of the intake valves may be sticking in their guides or the springs may be so weak that the valves do not close properly. Gummed oil in the guide will cause them to stick. Kerosene will remedy this condition.

Now examine the intake manifold for leaks. Make sure that the gaskets are in perfect condition and properly seal the joints. If backfiring is not eliminated try readjusting the carburetor. Determine that the flow of gasoline from the storage tank to the carburetor is not impeded and that the screen in the carburetor is not clogged. If you seek for the trouble in the systematic manner suggested, it will be easily located.

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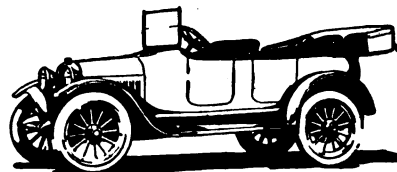
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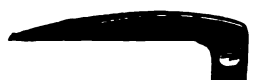
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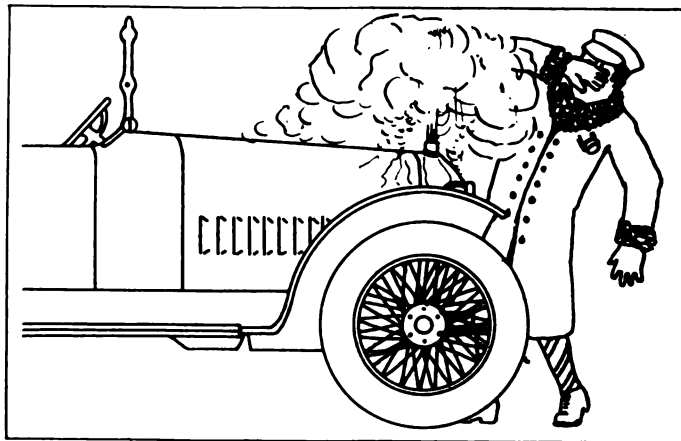
NON-SKID CHAINS.

Non-skid chains should always be carried in the car. There is no telling when the conditions will be such that it is imperative that they be fitted to the tires to insure the safety of the car and passengers. After removing the chains from the tires do not throw them in a corner of the garage. Wash them and place them in the car where they will be handy for immediate use.

CARE OF OVERHEATED MOTORS.

Much space has been allotted to the subject of the causes of an overheated motor. No doubt the first symptom apparent to the operator that the motor is overheated is the appearance of steam working out around the threads of the radiator filler cap. The only other exit for the steam is through the overflow pipe. Because the latter is the only free passage for the steam, when it is seen escaping from the radiator cap, it is proof that it is being forced out by pressure. One of the commonest mistakes made by the new, as well as many experienced drivers, is to unscrew the radiator cap and peer into the radiator—often to his keen regret. If there is water in the radiator and sufficient steam has been developed, the instant the radiator filler cap is removed, the escaping steam will cause a minute geyser of scalding hot water to spout several feet in the air. An example of this is shown in the accompanying illustration.

This condition will not always be experienced, as many times when the cap is removed, only steam will escape. It



When Filler Cap Is Promptly Removed from Radiator of Overheated Car Scalding Hot Water Is Apt to Spout into the Operator's Face.

may be that all of the water has boiled away.

It is poor practise to cool the motor by promptly pouring cold water into the radiator. Metal which is very hot and which is suddenly cooled is apt to crack. When the motor is overheated the better policy is to raise the hood and allow the engine to cool for two or three minutes. The radiator cap can then be removed with safety.

REMOVING RUSTED NUTS.

Nothing is more stubborn than a nut which has become rusted onto the bolt. Many times it can be removed by soaking kerosene around the threads. Another method is to direct the flame from a blow torch on to the nut. Heat the nut, but not the bolt. The heat will cause the metal to expand and it then can be loosened by tapping lightly with a hammer.

RAIN PROOF SOLUTION.

A solution that is recommended by experienced motorists for making the windshield proof against rain adhering to it is made of one ounce of water, two ounces of glycerin and one dram of salt. This should be mixed thoroughly and applied with a piece of gauze, taking care that all the strokes during application are made downwardly.

SOLDERING.

By the term soldering is meant the process of joining two metal bodies together by means of an intermediate film of another metal. There are two ways of doing it, the technical names for which are, true soldering and sweating. The latter is the simpler method, but it is not always practicable or possible owing to adverse conditions.

Sweating consists of coating the two surfaces of the parts to be joined with solder and then heating them until the solder liquifies. When it cools it forms a film between the parts and holds them together. This is the process generally used in connecting the union nipple with the gasoline line of motor vehicles.

If this fuel line should become broken and the tube can be stretched sufficiently to form a passage from the storage tank to the carburetor, the following method of repair will be found practical:

After shutting off the supply of fuel at the tank, remove the gasoline line from the car. To take out the short section of pipe from the nipple, hold the latter in a bright flame until the solder has melted. However, if this nipple has been brazed on, it will require a much higher temperature than afforded by the ordinary blow torch to liquify the solder, because the intermediate film is brass, which has a high melting point. It is advisable to drill out the tube, taking care that the nipple is not injured. If it should be damaged even slightly it is better to replace with a new one than to try to use it again.

The first operation in the repair is to level the end of the tube by using a file, and then to clean the outside surface as thoroughly as possible for about an inch back from the end. Use a fine emery cloth for this purpose and be patient, because while the surface may appear clean it also may not be. It may be oxidized through the action of the atmosphere on the metal, and in that case the solder will not adhere. Repair men and all others who do soldering use a flux to afford a purchase for the solder.

The next step is to make certain that the tube is small enough to be inserted in the nipple, and then the inside of the latter should be cleaned thoroughly. The flux should be applied to both the inside of the nipple and the cleaned surface of the tube, and then two or three small chips of solder placed in the nipple. Hold the latter in a pair of pliers in the flame and allow the solder to melt until by turning the nipple the entire inside can be coated with it. This is called tinning, and should be done to the outside surface of the tube also.

Before inserting the tube in the nipple be sure to replace the union nut. The final operations consist of holding the joint in the flame until the coating of solder is melted, and then thrusting it quickly into cold water. When rough edges are left they can be easily removed with a file and emery cloth.

REPAIRING CRACKED WATER JACKET.

If an anti-freezing solution is not used and the car is exposed to extremely low temperatures, a crack is apt to develop in the outer wall of the cylinder water jacket. Of course the most workmanlike repair is to have the part welded by the autogenous process. If such equipment is not available, a satisfactory repair can be made by the use of a few copper chippings and a blow torch.

It is necessary first to prevent the crack from spreading. This can be accomplished by drilling and tapping a small hole at each end of the flaw. After graphiting the threads, insert small studs in the holes. Next thoroughly scrape and clean the area around the fracture and apply a liberal amount of soldering flux to the crack.

From a piece of soft copper cut a number of small chips and place them over the crack and direct the flame from the blow torch on them. The copper will quickly liquidize and flow into the fracture. It is imperative that the crack be as clean as possible. Any superfluous metal can, of course, be scraped off after the repair.

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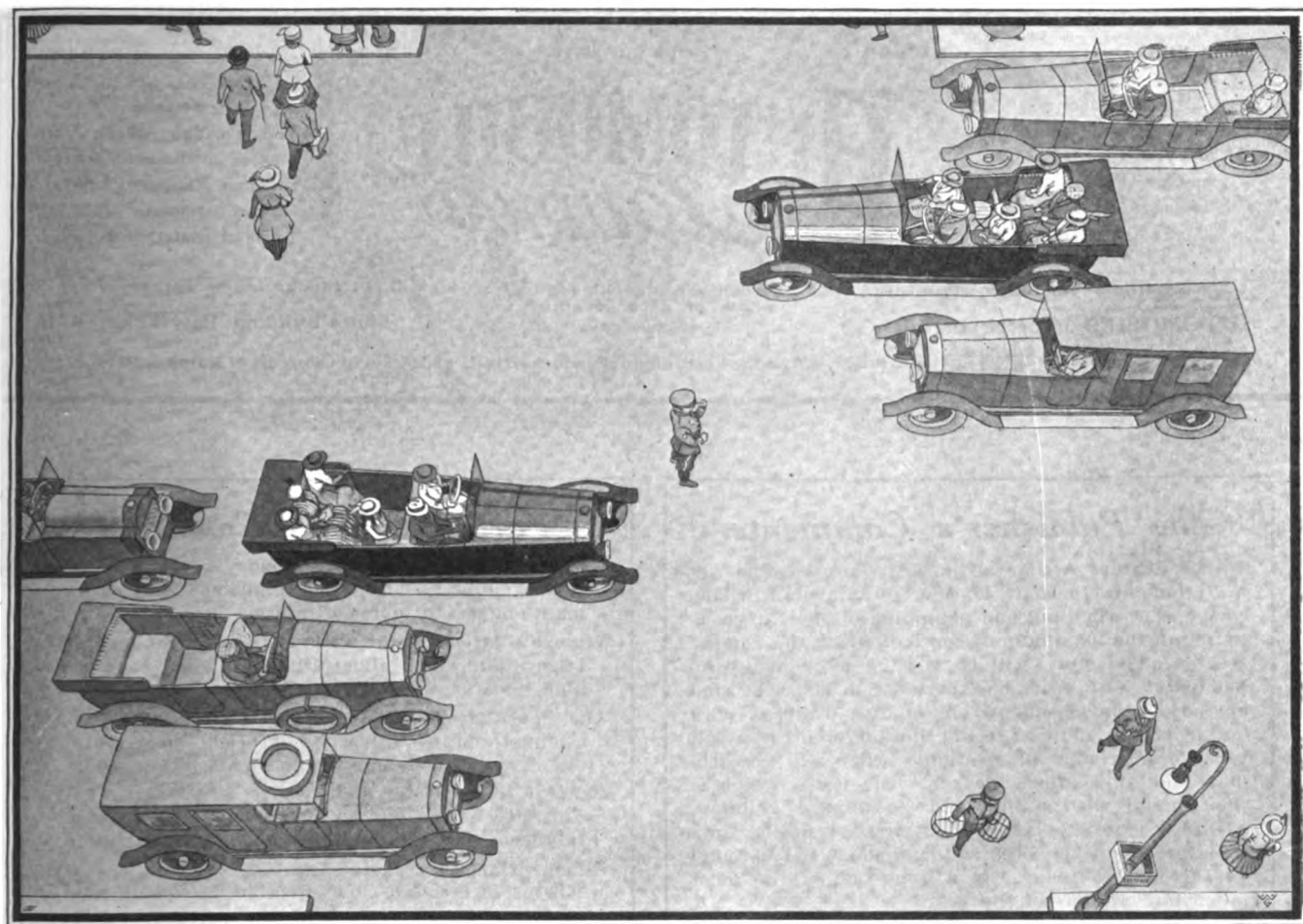
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*From a stand-still to 25 miles per hour IN ELEVEN SECONDS
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AUTOMOBILE JOURNAL PUB. CO.

Published the 10th and
25th of Each Month.
Ten cents a copy.

D. O. Black, Jr., Secretary.
Times Building, Pawtucket, R. I.

Entered as second class matter, April 15, 1906, at the Postoffice at Pawtucket, R. I., under Act of Congress of March 3, 1879

VOL. XLII.

APRIL 25, 1916.

NO. 6.

The Publisher's Comments.

THE Feature Article of the next issue of The Automobile Journal, the May 10 number, will concern the overhauling and equipping of the car so as to obtain the maximum of service during the coming season. The story will be written by a man who has had several years of experience in just that kind of work and consequently he is able to speak with authority. In addition to the hints offered there will be several original illustrations, which will serve to make the suggestions clearer. The issue, which is the Annual Overhauling and Equipment Number, will also contain a large number of descriptions and illustrations of the best car equipment to be found on the market today. It will be one of the most important editions of the year.

The Technical Editor again finds it necessary to remind correspondents that to obtain immediate and satisfactory replies in the Correspondence Department, or by mail, it is essential that complete specifications of the components mentioned be given in each letter. Furthermore, it is necessary for inquirers to sign their letters with their full names and addresses. This is required to show good faith on the part of the writers and also to allow the editor to write for further information if necessary. The names will not be published. Also please make the inquiries as brief as possible, without omitting essential details.

In Answer to Several Inquiries recently received the Publisher takes this means of advising that the Automobile Mechanical Books mentioned were prepared by motor vehicle authorities for this publishing company and that they are printed and distributed from this office. The complete set consists of 11 books, which are profusely illustrated with photographic views, sketches and diagrams and are devoted to non-technical discussions of the Engine, Carburetor, Magneto, Battery, Chassis, Car Operation, Lighting, Tires, Overhauling, Truck Operation and Motorcycle. They are authoritative and dependable.

Subscribers Will Confer a Favor and obtain no little benefit themselves if they will always mention The Automobile Journal when writing to advertisers and the makers of the equipment and accessories described in each issue of the magazine. This accessory department is maintained especially for the benefit of readers so as to acquaint them with the latest and best devices that have been developed to add to the pleasure and reduce the expense of operating motor vehicles.

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REO

Oversold—Oversold!

ON MARCH FIRST there were on hand at the Reo factory more than 4,000 orders for immediate shipment.

THAT'S MORE ORDERS than were ever on hand at any one time in the history of Reo—and oversold is the normal condition with us.

THOSE ORDERS WERE just about equally divided between Reo the Fifth and the New Reo Six. The first, the incomparable Four at \$875, and the other, the original sheer-line seven passenger Six at \$1250.

NOW JUST CONSIDER that that was not May first but March first. And that this was the year when other makers seemed to lose their way in a maze of "cylinders"—the year when, you were told, that "flocks of cylinders under the hood" would be the charm that would bring sales.

AND REMEMBER TOO that this over-demand is not due to under-production—for between January first and March first this year we shipped 150 per cent more pleasure cars and more than 400 per cent more motor trucks than during the same period last year!

AND THE ENTIRE LINE is selling strong—there are no lagers in the Reo line. Orders run just about in ratio of production schedule—but more orders than cars for all lines.

DON'T YOU ENVY those distributors who are so fortunate as to have the Reo line? Isn't it your ambition to some day handle a line of cars and trucks that will make good on every word you say about them?

65 PER CENT OF THOSE WHO handle Reo cars and motor trucks handle this line exclusively—and they are the most successful class of automobile dealers in this country.

NOW DON'T THINK that this ad is a bid for dealers. Not at all. We don't need to do that. We seldom change—never when the distributor does his part by his patrons. Never when he really represents Reo and the Reo policy.

BUT IN ISOLATED CASES changes must be made from time to time. Your territory may just happen to be one of them. So it behooves you to be on the alert—the chance to get the Reo line happens only once in a life time. Write us, get your application on file—it will be treated in strict confidence of course.

AND THEN, should the unexpected happen, you'll be in line for that which is the ambition of every first-class dealer—to handle Reos.

(135-A)

REO MOTOR CAR COMPANY Lansing, Mich.

(When Writing to Advertisers, Please Mention The Automobile Journal.)



It's the same old COES

How often have you heard the repairman, machinist or shop manager say, "It's the same old Coes, just as good as the day I bought it—it will last forever."

That is evidence of the quality that has made Coes wrenches the standard the world over.

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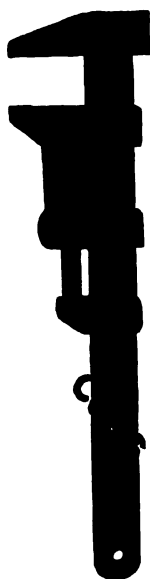
The material is selected with the same care, made by equally experienced and trained wrench makers, in a factory which specializes in wrench making. The wrenches are finished carefully and many times tested to assure the quality that will meet every requirement placed upon them.

Car owners who know wrench values demand the Coes. It is most popular with automobile repairmen, and in every other line of mechanical work Coes Wrenches will be found on the benches and in the tool kits of the expert workmen.

Coes wrenches can be had in just the size to fit any use. Any Coes will afford the same long and satisfactory service. It is always dependable and from the standpoint of wrench service it is the cheapest wrench produced.

Coes wrenches are sold wherever motor cars are used. They may be had of all jobbers, automobile supply houses, and automobile and hardware dealers.

Catalogue on request.



Coes Wrench Company, Worcester, Mass.



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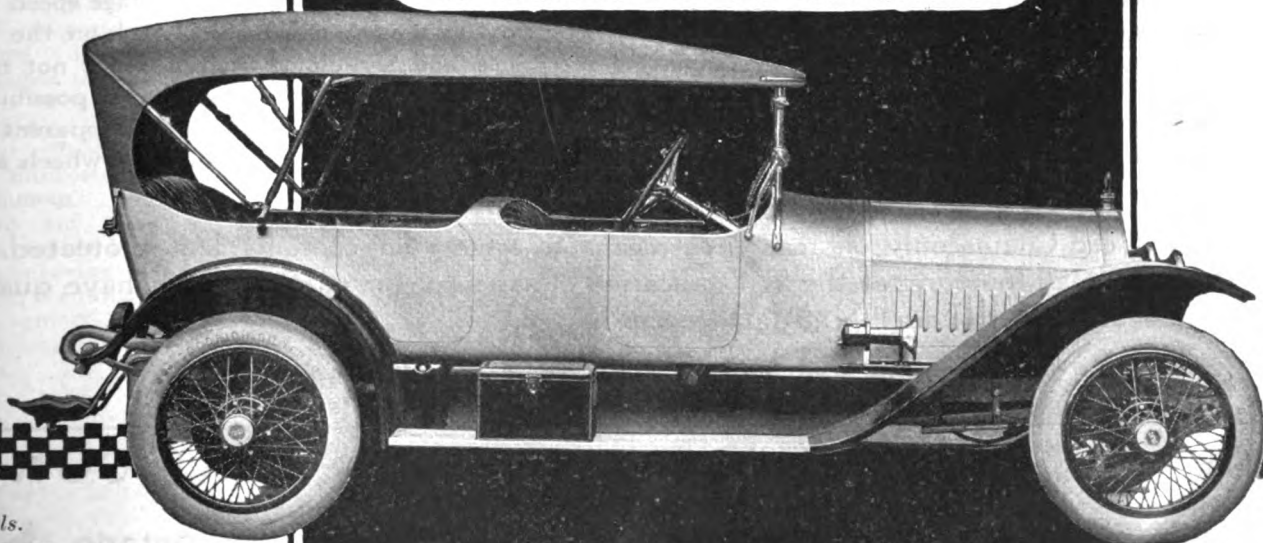


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Records 250;300;350 mi.

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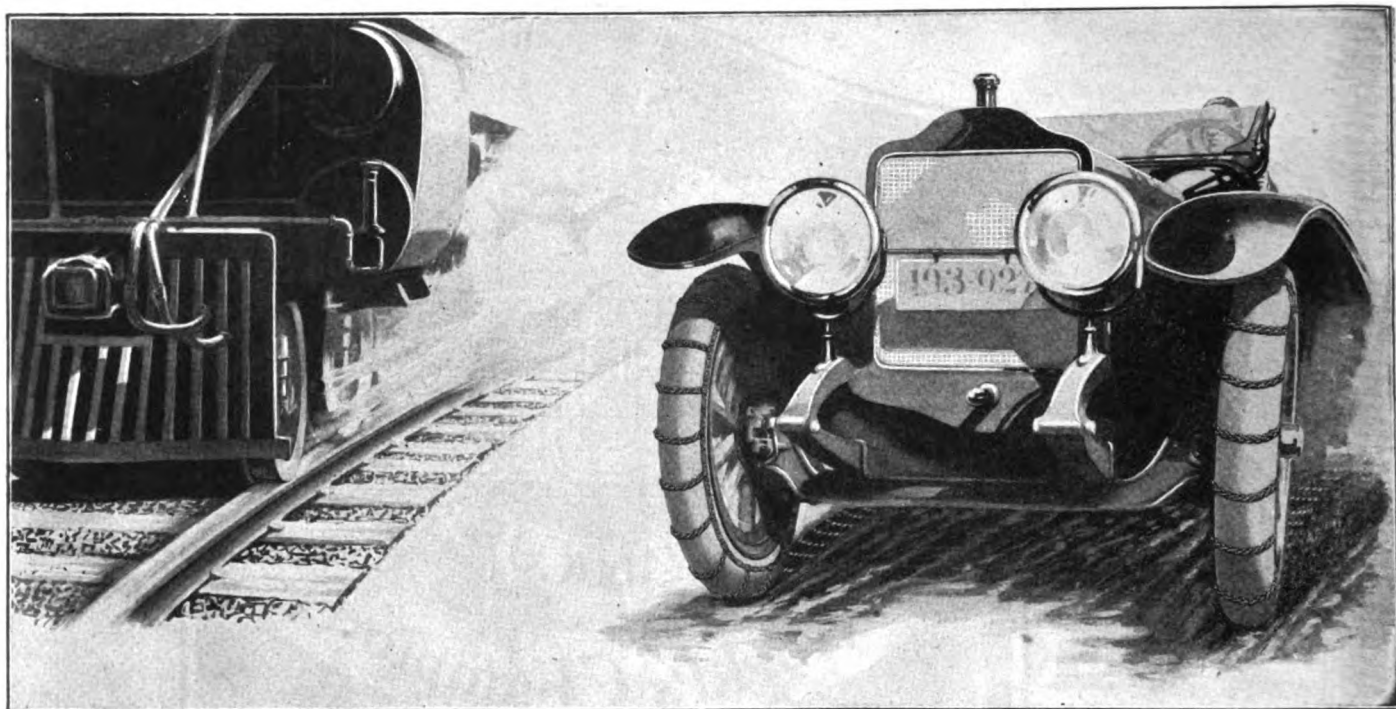
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STUTZ MOTOR CAR CO.

Indianapolis, Indiana

(When Writing to Advertisers, Please Mention The Automobile Journal.)



Front Wheel Control

Weed Chains on front tires of motor cars are as necessary as flanges on front wheels of locomotives.

The front wheel skid is the greatest cause of the many automobile accidents which keep the newspaper columns sprinkled with harrowing accounts. Appreciating this fact *The Scientific American* in the following editorial advocates the use of Tire Chains on the front as well as rear wheels:

"The majority of automobile owners fit chains to the rear wheels only, and appear to consider this ample insurance against accidents from skidding, but this practice is a doubtful economy, for, although the rear wheels, thus armed, may hold the road fairly well, the really bad accidents too often result from the inability of the driver to control the course of his machine. Any old bicycle rider knows that he can retain the control of his machine and maintain his balance when the rear wheel skids badly as long as the front wheel holds its

grip on the road, but that he becomes helpless whenever the front wheel slides. The same conditions are true in the case of the automobile, but in an exaggerated degree, for its weight and the average speed both tend to make the grip of the front wheels on the road precarious, and a skidding front wheel is not much different from a broken steering gear in the possibilities of disaster. Recognizing these facts, it is apparent that chains are fully as necessary on the front wheels as on the rear."

To use Weed Chains only on rear tires means to have your car only half protected. Put Weed Chains on all four tires at the first indication of slippery going and you will have quadruple protection against injury, death, car damage and law suits.

Weed Chains Are Sold for All Tires by Dealers Everywhere

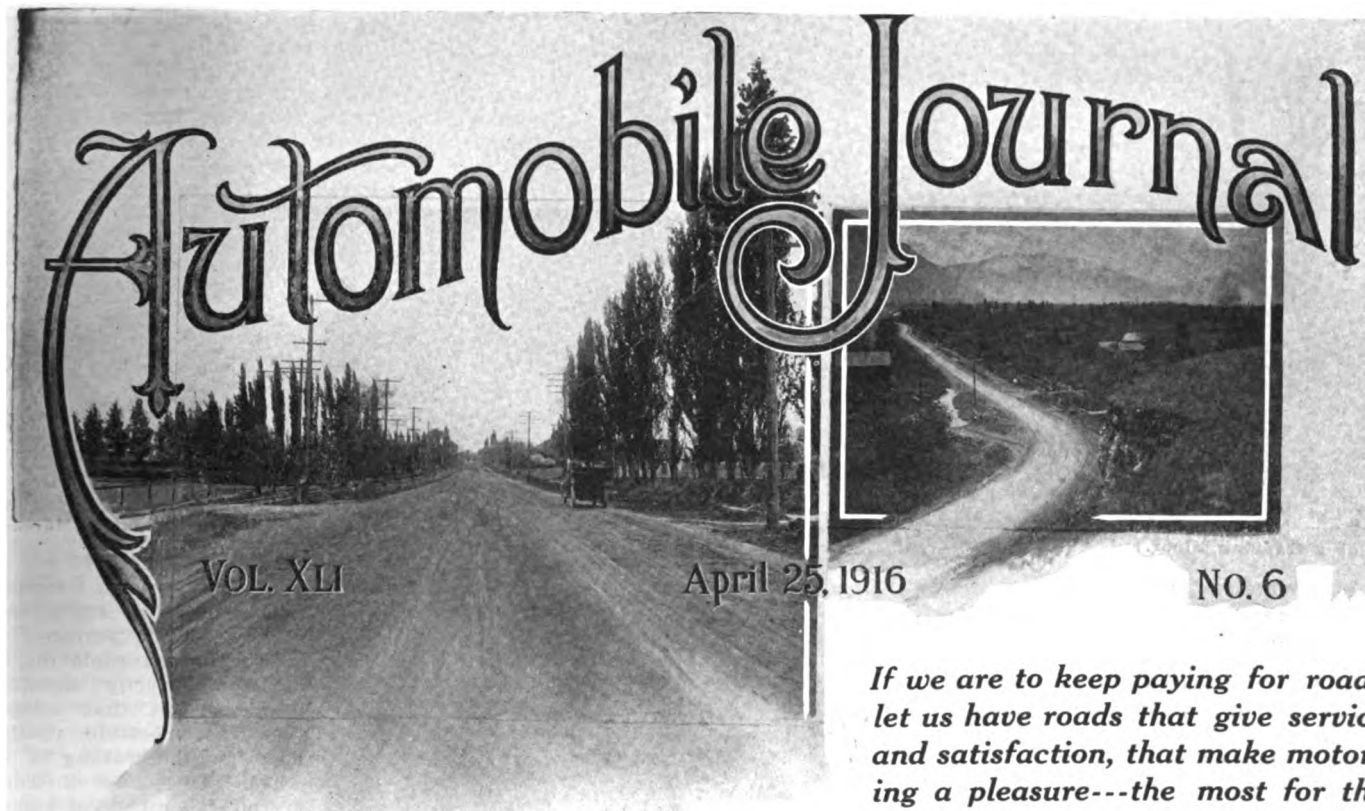
AMERICAN CHAIN CO. INC., BRIDGEPORT, CONN.

Sole Manufacturers of Weed Anti-Skid Chains

In Canada—DOMINION CHAIN CO., Ltd., Niagara Falls, Ontario.



(When Writing to Advertisers Please Mention The Automobile Journal.)



If we are to keep paying for roads let us have roads that give service and satisfaction, that make motor-ing a pleasure---the most for the money.

(By a Car Owner Who Desires Good Highways.)

A Motorist's Views on Good Roads.

MOTORISTS who number now over 2,500,000 the country over will contribute in registration and license fees alone probably more than \$15,000,000 this year to the funds from which roads are built. But that is by no means all the taxes they will pay for road purposes. Their cars are assessed as personal property and their other holdings pay their quota to the state, county and town funds from which road construction is financed. They pay taxes to the Federal government on goods they consume as well as income taxes, and if pending legislation is passed a part of that money will be used for road construction.

It is estimated that \$250,000,000 a year is being spent for roads and it is probably a safe estimate that at least half of that amount is paid in taxes by people who own and use motor cars. For that reason, as well as because he uses the roads and is immediately affected by their condition, every motorist should be deeply interested in this problem.

I do not mean that he should have an engineering or technical knowledge of the subject—that is a matter for engineers. But he should take the trouble to observe road conditions, which he has the best of opportunities to do, and decide for himself which of the many kinds of roads that are being tried are giving the best service. Then he should be interested enough to use whatever influence

he may have to see that the best are laid in his locality.

For the past several years I have done a great deal of driving over New England roads at all seasons of the year, and I have kept my eyes open and thought much about roads. In the early spring especially there is often much occasion for thought about them, every car owner must admit.

Rock Material is Plenty.

Perhaps because of the abundance in which rock is found in the New England states, rock roads of various types were developed early and have been extensively built. The early roads of this type were all of the old water bound macadam construction. These served well as long as only steel tires were used on them, but they speedily showed their weakness under fast moving rubber tired motor vehicles. Some of them are still being built, however, because the first cost is slightly less than that of the modern tar macadam roads.

Tarviated roads last longer, in fact, indefinitely if they are kept in repair.

About 10 years ago tar macadam roads made with tarvia began to be built. The first one was laid at Newton, Mass., I believe, and it is still in excellent condition. A tremendous amount of road of this kind has been put down by the Massachusetts highway commission. You can start from Boston on a Sunday morning and ride all day and scarcely get off it. They have it in



Where a Tar Macadam Road Meets Unimproved Dirt Highway in the Early Spring.



A Tar Macadam Road After Four Years' Use—Smooth as a Dancing Floor.

the mountains and nearly everywhere else the state road system penetrates.

These roads are maintained as well as built by experts. It is a fixed principle to make slight repairs as soon as the smallest wear in the surface of the road is apparent and the result is that upkeep cost is very low, while the roads are in almost uniformly perfect condition.

The great secret of keeping roads in good condition—engineers says—is to keep the water out of them. That is the great service performed by the tar ingredient in tar macadam. It prevents the surface and binders from being pulled out through suction of the tires or calks from shoes of horses. Water collects in the holes from which the stones are drawn out, soaks into the roads and freezes there in the cold season. The expansion heaves the road up and this accounts for the countless ridges and holes and beds of loose stone that are to be found especially in the spring in a road of that kind.

I was riding this spring along one of the finest boulevards in New England—fine in every respect except as to the road surface—when I came to a place that heaved up in that way during the past winter and left ridges and loose stone lying about. I took a picture of it, one of which I enclose. I think this is an excellent illustration of the kind of surface break that is unavoidable with this type of road and which one constantly sees everywhere.

In the early spring just after the snow goes and the ground is still thoroughly wet is the time when one can form the best estimate of the value of good roads. You get an especially vivid impression when you come across a place, where a fine stretch of tar macadam ends and your car dives into a slough of mud in a natural dirt or unimproved road. One of the accompanying photographs illustrates this case very fully.

There are also several photographs of tar macadam roads, every one of them laid four or more years ago and each of them still as perfect as a road can be. One of them shows a turn that probably carries as much traffic of all kinds as any in New England and which is nevertheless in perfect condition this spring after one of the hardest winters on the roads that the section has seen in a long time.

Past Winter Hard on Roads.

The past winter has been exceptionally hard on dirt roads and the old fashioned water bound macadam type. They were covered with snow and ice for an unusually long time, yet they say that it is usually good for roads, since it protects the surface from the wear it usually gets. But this year just before the snow and frost came there was an unusual stretch of wet weather which thoroughly soaked the roads before they froze. This broke them up worse than they have been



A Straightaway Stretch of Modern Tarviated Macadam Highway.



Turn on Tarviated Road After a Hard Winter—A Perfect Surface.

in many years, except where they had exceptionally well made surface.

The tar macadam roads have a perfectly smooth, even surface that offers the least possible resistance to the rolling of a wheel. Of course if they are not taken care of water will get under them and throw them up in ridges, just as it will any road whatever, but still they are very easily and quickly repaired.

Freezing and thawing is a condition that all American roads in the northern part of the continent have to stand. The alternately freezing and wet weather makes it necessary that they be as near water proof as possible. The only reason that Appian way and the famous stone roads built by the Romans have endured as long as they have is that they are in a climate where it never freezes and, therefore, the deadly effects of frost on the roads is not felt.

But repairs on tarviated roads if they are made in time are very simple and inexpensive. The first tarvia road laid at Newton, Mass., on the boulevard, is five miles long and 60 feet wide and the maintenance cost for the whole stretch has been only \$1200 and I know of no road used more steadily.

As soon as the top coat that serves as the water shed begins to wear it is pulled off the road entirely and a new layer is laid. If wear has gone no further that is all that is necessary. If the road has been neglected and wear has affected the bed, it is necessary to level that up with crushed stone and other material, roll it evenly and then put on the tar top.

Other Types Can Be Converted.

Almost any kind of a road, no matter how badly broken up, can be converted into tar macadam by much the same process. The old road is leveled up by filling in with crushed stone, rolled and then surfaced with one of the preparations of refined tar which are known as tarvia.

I personally am very strongly in favor, as a result of my own study and experience and observation, of tar macadam roads for all new construction in generally used highways, and for the conversion of roads of the less successful types when they reach the point where it is apparent that maintenance by the original methods is becoming too costly. To properly repair a macadam road it must be practically rebuilt again.

I am confident that thousands of other motorists will agree with me when they have given their attention to this subject. The importance of the question at present lies in the fact that a great amount of new construction is going forward and the returns in public service that are secured from it will be directly proportionate to the attention that is given the work by motorists and others who are well informed and

the extent to which they use their influence to see that these new roads are well built.

According to late records \$25,773,135 were spent for road construction and maintenance in New England in 1914, and as interest in good roads has increased steadily since that time, it is probable that the expenditure for this year and for next year will be considerably greater. This amount will maintain the roads already in existence and build much additional.

The figures show the size of this undertaking and its importance to the public. They show the following facts regarding the various states:

	Total Spent 1914	Surfaced Roads	All Roads	Pct. Built Surfaced 1914
Maine	\$3,537,598	3,264	25,528	12.8
New Hampshire...	\$2,052,173	1,025	15,116	6.8
Vermont	\$1,481,467	3,278	15,082	22.7
Massachusetts	\$6,020,609	8,928	17,272	51.7
Rhode Island	\$584,598	1,246	2,121	58.8
Connecticut	\$5,096,782	3,300	12,582	26.6
	\$25,773,135	21,041	77,601	99.4

To build any kind of road will be somewhat more expensive this year than it has in the immediate past. This is due to the fact that the cost of labor is more and some materials have generally advanced in price. While there is no way of avoiding the increased labor cost, except by the use of convict labor, which is becoming constantly more common, the additional cost of materials can be avoided to some extent by the selection of the type of road.

One of the greatest advances in cost is that of road oil, which along with gasoline and other petroleum products, has gone up nearly 100 per cent. in the last year. This is used largely on water bound macadam and dirt roads to keep down dust. It is unnecessary on a tar macadam surface, which is another big factor in favor of the tarviated road.

The use of oil on roads has many draw backs, yet on the macadam road it is most durable. It makes the dust too heavy to blow when it is first put on, but it does not bind it firmly as does a tar covering. The result after the effect of the oil has worn away somewhat is heavy black mud or dust. New oil cannot be applied while the road is partly wet, while what oil remains makes sprinkling with water ineffective in laying the dust. These problems, along with many others, disappear when tar is used. I feel that the best roads are tarviated roads, especially where motor vehicles are the most extensively driven. On special road construction, where specially made roads are necessary, I have nothing to say. I believe the cost of the tar road is consistent with the service and that the upkeep cost should be but a small part of

that for their construction. If I am right it is time for all other car owners to observe and give us their conclusions.

ROAD CONSTRUCTION IN ALASKA.

Construction of roads in Alaska is under the direction of Col. W. P. Richardson of the United States army, who works under the direction of the War Department and is also president of the Alaska Road Commission. Since 1906 the commission has constructed 901 miles of wagon roads, 557 miles of winter sled roads and 2216 miles of trails. The average cost of the wagon roads has been \$3000 a mile, of the sled roads \$325 and of the trails \$100 a mile. The figures include surveys, maintenance and overhead since the beginning of the work.

None of the roads is classed as an automobile road and the use of the automobile on them has not been encouraged, but 100 trucks and passenger cars are in use on them. Summer traffic on the Fairbanks-Valdez road has been steadily increasing. On the Juneau-Sheep creek road 10 public motor cars have been transporting passengers at a daily rate of five or six hundred.

The roads that have so far been constructed have effected great savings in the transportation of freight. In 1912 the cost of hauling freight over the roads was \$1,243,735. Before the roads were built the cost of transporting the same freight would have been \$3,385,412. The saving thus shown as due to the construction of the roads in a single year amounted to \$2,141,677, or about the total amount expended on the road and trail system of the country, or about 16 per cent. of the total value of the mineral product of Alaska in 1912.

Good roads in the United States would save every year several times the total cost of Alaska to the United States.

ROADS BILL IN THE SENATE.

Those interested in good roads in all parts of the country are using every effort to convince the Senate, which has a good roads bill before it, that this measure should receive as great attention as the preparedness programme. Great insistence is being placed on the necessity of prohibiting the

use of federal money for maintenance purposes, because it might be dissipated in that way without much progress being made in building new roads. It is also held to be necessary that the states contribute an equal share with the federal government to the construction of all roads, as otherwise local initiative might be discouraged and states would wait for the federal government to do the work. These are a few of the evils which must be overcome.



Upper View—Removing the Old Surface for Slight Repairs to in the Spring—Ruts Are Plenty. Lower Left—A Water Bound Macadam Road Rutted by Frost. Lower Right—One of the Finest Boulevards in New England with Old Style Macadam

WOMEN'S ATTIRE FOR THE TOUR AND THE STREET.

EVEN a casual survey of the women's apparel shops will convince the feminine motorist that the costume designers have not sacrificed attractiveness for utility—in fact, they have retained both in this season's garments. Coats, those prime necessities of every woman who rides in an automobile, conform to the lines laid down by the fashion dictators and are made in a large variety of lengths, styles and materials to suit the taste of even the most fastidious dresser. In addition, they provide that degree of warmth and comfort which is a

up to the chin to keep out rain or wind. At the back there is a well fashioned belt which serves to break the lines from collar to hem. The double row of buttons down the front not only keep the coat securely fastened, but furnish an attractive touch. Altogether it is a comfortable and distinctive model. The pockets are slit and capacious and can be used when either side is in use.

Among the suits displayed in these pages there is an exclusive design made of regulation army cloth and in norfolk style. It is designed primarily for outdoor sports and avocations and is waterproof. If desired one can obtain a regulation cartridge belt with this model and wear the suit on hunting trips. Military effect is given by cut, material and the pockets, two of which are in the coat and two in the skirt. The trim turnover collar is a distinguishing feature.

Turning to the coats again, there is the warm, but light garment of bolivia cloth, which is one of the latest designs evolved by the coat makers. This is a most desirable garment for this time of the year and for those chilly summer nights motorists often encounter in the hilly and mountainous districts. It can be worn either as a motoring coat or on the street and can be obtained in any of four of the season's most fashionable colors, purple, brown, navy and light green.

Another leather coat illustrated on this page is a tan leather short model in norfolk style. A striking contrast is had by the sleeves and pockets being trimmed with the same shade of green leather of which the collar and belt are made. Its design is distinctive and especially suited to the younger women and girls. It is an



Above Is a Ladies' Wool Jersey Suit in Green and Rose with Belt All Around Coat and with Two Patch Pockets and Plain Skirt. Price, \$37.50.



Military Norfolk Suit in Regular Army Cloth, Turnover Collar, Four Patch Pockets, Inverted Box Plait Down Back of Coat—Plain Skirt with Two Patch Pockets Price, \$50.



Gray Mannish Mixture Suit, Plait Down Sides of Coat, Pockets Trimmed with Two Buttons, Five Inverted Plaits from Waist Line Down—Plain Skirt. Price, \$29.50.



Blue and Black Mannish Serge Suit, Convertible Collar, Cluster Plaits on Each Side of Coat Below Waist Line. Plain Flare Skirt with Patch Pockets. Price, \$25.

necessity while on the road.

A noticeable feature of the coat and suit designs is that these garments are generally provided with high convertible collars to afford full protection to the throat and chest against raw winds and rain. Pockets are deep and spacious and most generally are of the slit and patch types. Lengths are according to taste and occasion, they ranging from the short jacket and knee length models to three-quarter and full lengths. In the matter of materials, the makers have shown a tendency to adapt such goods as will be light in weight, but still, to a large extent, be impervious to sharp winds.

Leather, both as a material and as trimming, is given a very prominent place in this season's motoring costumes. Even the milliners have seized upon it for its practical utility and have designed some very attractive sport and street hats. Fabrikoid is being used for millinery and will be seen very frequently on the highways this spring and summer. In luster and durability it has an appeal that few women can resist.

In the illustrations shown herewith there is an all-weather coat which every woman would like to have for touring. It is really two coats in one, one side being of deep brown leather, while the reverse side is of tweed. While en tour, or during stormy weather, the coat would be worn with the leather side out. The tweed side would be used during pleasant weather and while walking.

This coat affords full protection to the wearer's suit or skirt. The collar is high and can be securely fastened close

all-weather garment, which is extremely practical.

Black and white check material is again in vogue this season, and a splendid example of this in a coat is shown at the top of the page. This has a high leather collar and leather buttons and



**Black and White Check
Worsted Auto Coat,
Big, Full Sleeves, Slit
Pockets, Leather Col-
lar, Leather Buttons,
Lined Throughout.
Price, \$40.**



**Two Views of Convertible Coat of Leather. Figure at
Left Showing Leather Side, While at Right is the
Tweed Side. Coat Has Slit Pockets and Belt Across
the Back. Price, \$69.50.**



**Novelty Mixture Coat,
Convertible Collar,
Belt All Around
Price, \$25.**



is lined throughout, making a very serviceable garment for motorists.

A good example of the convertible collar as designed for this season's wear is shown in the novelty mixture coat in yellow effect. This collar has imitation button holes piped with yellow broadcloth. There is a broad belt of the same novelty mixture material all around the coat.

A striking suit, which is suitable for both the tour and street, is a wool jersey model. This suit is furnished in green and rose, two of the season's most desired colors, and has a belt around

the coat with two patch pockets and a plain skirt. In this model the convertible collar is also used, it providing protection against chilly winds.

Among the season's offerings are several mannish mixture suits, two of which are shown on the opposite page. One is a gray mixture with plaits

down the sides of the coat and five inverted plaits from the waist line down, which gives that form fitting effect for which designers have striven this season. Buttons are used liberally as trimming this year, and on this coat the pockets are trimmed with two buttons each. The skirt is plain, with a suggestion of the approved flare.

A very attractive design is seen in the blue and black mannish serge suit at the bottom of the opposite page. There is a very practical and attractive convertible collar, which affords full protection against dust and wind. Below the waist line there are clusters of plaits on each side of the coat.

The coats and suits described and illustrated on these two pages are the choicest designs offered by the A. Shuman & Co., one of Boston's leading clothiers and outfitters.



**Tan Leather Short
Coat, Norfolk Style.
Green Leather Col-
lar and Belt.
Price, \$35.**

**Bolivia Cloth Coat in Purple,
Brown, Navy and Light Green,
Sides Gathered with Belts, Slit
Pockets, Turnback Cuffs, But-
ton Trimming. Price, \$50.**



Photographs and Descriptions by Courtesy of A. Shuman Company, Boston, Mass.



*Priced at \$775 with
Complete Equipment*

*Roadster and Touring
Types or Bodies*

ONE of the oldest and best known of the horse vehicle companies, the Kentucky Wagon Works, Louisville, Ky., which has been making a commercial truck for some time, has turned its attention to the passenger car field, and is producing a handsome and well designed touring model.

Appropriately for a car built by a southern manufacturer and intended to appeal especially to southern buyers, the car has been named the "Dixie Flyer."

The plant in which this car is made is not only old and well known in the vehicle trade, but has recently been organized on the most modern efficiency lines to bring its manufacturing ability to the highest current standards.

Lycoming Motor Used.

The motor is made by the Lycoming Foundry and Machinery Company, Williamsport, Penn. It is of the unit type, four-cylinder, cast en bloc, with flywheel and clutch mechanism enclosed, and has three-point suspension. The manufacturer's rating is 30 horsepower and the cylinder dimensions are $3\frac{1}{2}$ by five inches. It is a high speed design, yielding a smooth, continuous flow of power at all speeds. Cylinders are of the L type and valves are enclosed and noiseless. The water cooled head is removable and is fitted with an inspection plate.

The crankshaft is drop forged from .40-50 carbon steel and is double heat treated and $1\frac{1}{4}$ inches in diameter. The

dimensions of the front bearing are $1\frac{1}{4}$ by $3\frac{5}{16}$ and of the rear bearing $1\frac{1}{4}$ by $4\frac{1}{16}$ inches. The connecting rods, wrist pins and pistons are balanced as to weight to within a quarter of an ounce. This exceptionally good distribution of weight in the reciprocating parts results in a uniform development and application of power. It is an example of vibrationless results that may be had in good four-cylinder design.

Efficient Lubrication System.

Lubrication is accomplished by the constant level circulating splash system. The lower half of the crank case contains four small wells, which are fed by a constant circulation of oil, flowing from a plunger pump operated by an eccentric on the camshaft. The connecting rod bearing caps are fitted with dip-pers which plunge into the oil wells and force lubricant into the moving parts.

Thermo-syphon cooling is employed. The water jackets are exceptionally large and each cylinder barrel is independent of the others, so that water can circulate freely all around it. The valve cages are similarly jacketed so that uniform and efficient cooling throughout the motor is assured. Both the inlet and exhaust valves and pipes are extra large. The aluminum fan is of the two-blade pattern and is belt driven and easily adjustable.

The carburetor is a standard float feed type designed to atomize the fuel efficiently under the most varied atmospheric conditions. The radiator is of the

honey comb cellular type. It is mounted on springs to protect it from vibration and breakage. The design has been especially developed for the Dixie car and assures much longer life than is possible with the usual rigid mounting. Springs absorb the shocks due to extremely bad road conditions and minimize the danger of damage or leakage due to that cause.

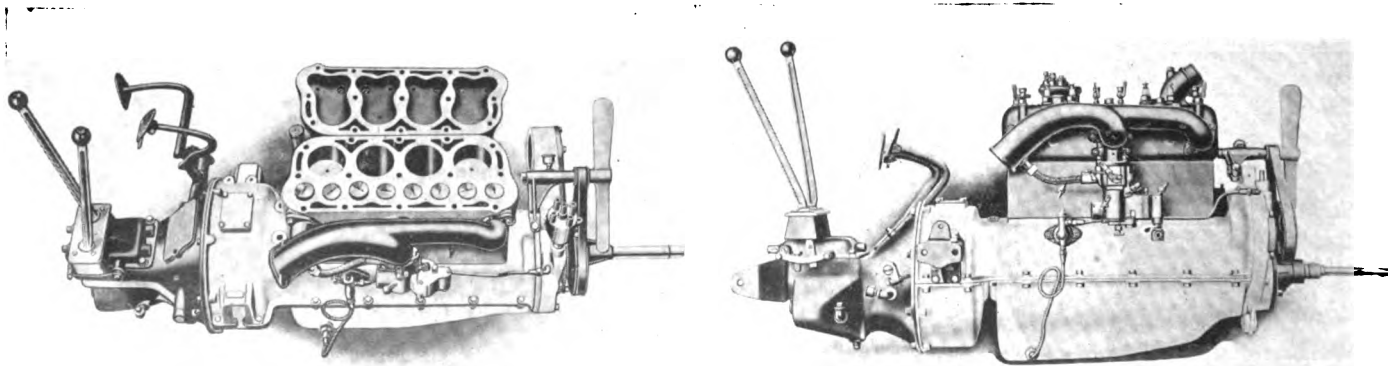
A cone clutch of pressed steel and faced with leather, under which there are six compensating plungers to insure easy engagement, is immediately behind the motor. The transmission gear-set of the three speed forward and reverse sliding gear type is made by the Grant-Lees company.

The Dyneto system is used for starting and lighting, the current for the single unit starter being stored in a Willard storage battery. A Connecticut distributor is used in the ignition system.

Special Design of Torque Rods.

From the transmission, drive goes through one universal joint and the propeller shaft. The torque is taken by specially designed fork and reach rods. The rear axle is a full floating type, in which no load is carried on the driving members, the entire dead and live load resting on the housing, so that both the live axles may be removed without jacking up the wheels. The diameter of the housing is two inches and of the drive shafts $1\frac{1}{4}$ inch.

The chrome nickel steel differential and large bevel gears are mounted on



Two Views of the Lycoming Motor Used in the Dixie Flyer Chassis, One Showing the Cylinder Head Removed to Demonstrate Accessibility and the Other a Side View of the Complete Power Plant.

high duty roller bearings with end thrust bearings on either side. All bearings are adjustable and every part is very accessible.

The brakes are double and of extra large size. The service member is external contracting on rear wheel drums and is operated by a foot pedal. An original feature of this pedal is a projection on the side arranged in such a way that the accelerator on the toe board may be operated without removing the foot from the pedal. The theory is that an inexperienced driver who gets into difficulties has an instinct to push forward with both feet. If he does this in the Dixie Flyer he will throw out the clutch and set the brakes.

The emergency brake is internal expanding and is operated by a hand lever in the front compartment. The brake linkage is under spring tension to prevent rattling.

Bodies are finished in a durable and handsome shade of deep bottle green with black enameled fenders.

The upholstery is deep tufted and luxurious and only the finest quality of coiled springs are used. It is built into a strong frame work that holds it in position and keeps it from sagging or packing into lumps.

The windshield is clear vision, rain vision and ventilating. Electric head lamps with dimmers are used. The top is a one-man type with improved side curtains and dust hood.

The instrument board contains a 60-mile speedometer cowl light, carburetor control and lighting and ignition switches. The weight of the car fully equipped is 2100 pounds.

Standard equipment includes an electric generator, electric starter, lights and horn, rim and carrier, license

COMING EVENTS IN MOTORDOM.

May.

May 6—Race, Sioux City, Ia.; speedway.

May 13—Race, New York City; Sheepshead Bay speedway.

May 20—Race, amateurs, Chicago, speedway.

May 26-27—Convention, three Pacific Coast auxiliaries of National Assn. of Automobile Jobbers, Del Monte, Cal.

May 30—Race, Tacoma, Wash., 100 mile speedway.

May 30—Race, Indianapolis; speedway.

May 31—Race, Minneapolis; speedway.

June.

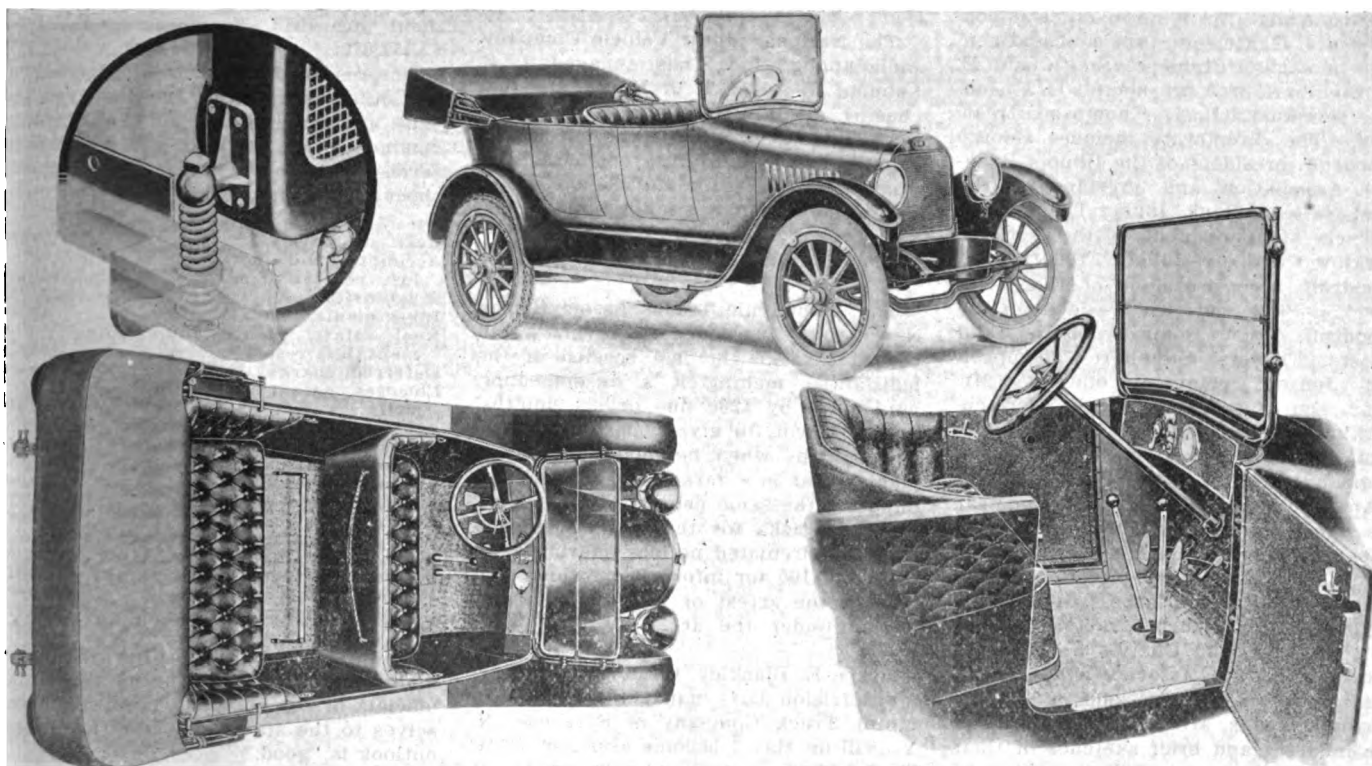
June 10—Race, Chicago, Ill.; speedway.

June 12-16—Mid-summer cruise of the S. A. E., leaves Detroit.

June 28—Race, Des Moines, Ia.; speedway.

July.

July 2-6—Convention, World's Sales-



Features of the Dixie Flyer—The Spring Mounting of the Radiator, the Roomy Interior of the Touring Body, the Spaciousness of the Front Compartment, and a View of the Clean Cut, Long Hung Body.

Wooden wheels of the artillery type are used with demountable rims, of which one extra is supplied. The frame is heavy pressed steel with three cross members. The springs are self-lubricating. Those in front are of semi-elliptic design, while the set at the rear are three-quarter elliptics of the scroll type.

Wheelbase is 112 inches. The fenders are of the high crowned type, while the sideboards are rubber covered with aluminum bindings. The gasoline tank is round and hung at the rear of the chassis. The fuel is fed to the motor through the Stewart vacuum system.

The two bodies offered on this chassis are a roomy five-passenger touring body, with stream lines of yacht type, which is unusually attractive, and a roadster of the same general appearance and with capacity to accommodate three persons.

bracket and complete tool equipment. The price of the car complete is \$775.

MARMON'S OILLESS BEARINGS.

In the new Marmon 34 the number of oil cups has been reduced from 30 or 40 to four. This has been accomplished by the use of oilless bearings, lined with an asbestos fabric, which are used for spring shackle bolts, brake rod bushings, and at other points that are difficult of access for oiling purposes and consequently are frequently forgotten. The new bearings were described recently in a British automobile engineering publication, and since that time the writer of the article has received scores of inquiries from British engineers regarding their construction and the source of supply.

manship Congress, Detroit, Mich.

July 4—Race, Tacoma, Wash., speedway.

July 4—Race, Sioux City, Ia., speedway.

July 4—Race, Minneapolis, Minn.; 300-mile speedway.

July 4—Race, Coeur D'Alene, Idaho.

July 15—Race, Omaha, Neb.; speedway.

August.

Aug. 5—Race, Tacoma; speedway.

Aug. 18-19—Race, Elgin, Ill.; road.

September.

Sept. 4—Race, Indianapolis; speedway.

Sept. 4—Race, Des Moines; speedway.

Sept. 16—Race, Providence; speedway.

Sept. 30—Race, New York City; Sheepshead Bay speedway.

October.

Oct. 7—Race, Omaha, Neb.; speedway.

Oct. 14—Race, Chicago, Ill.; speedway.

Oct. 19—Race, Indianapolis, Ind.; speedway.

Premier About Ready for Quality and Quantity Production.

New \$2,500,000 Car Corporation Has Strong Financial Backing and Well Known Personnel.

The Premier Motor Corporation, the new \$2,500,000 concern which has taken over the assets and good will of the Premier Motor Manufacturing Company and the Mais Motor Truck Company, is now practically ready to begin active operations. The plant of the T. B. Laycock Company, Indianapolis, has been rehabilitated and now affords 300,000 feet of floor space and covers approximately 40 acres of ground.

The organizers have spent months in building up the personnel to the ambitious standards that have been set for this company. As it now stands it consists of J. C. Flowers, president and general manager; Frank E. Smith and E. W. Steinhart, vice presidents; C. F. Jensen, secretary; H. L. Thompson, treasurer. The directorate includes George Woodruff, president of the Illinois Bankers' Association and president of the First National Bank, Joliet; Theodore R. Gerlach, vice president of the Gerlach-Barklow Company, Joliet; Frederick W. Woodruff, vice president of the First National Bank and vice president of the Woodruff Trust Company, Joliet, and Messrs. Flowers, Steinhart, Thompson and Jensen, company officers. Mr. Thompson is secretary of the Gerlach-Barklow company and Mr. Jensen president of the Vanguard Manufacturing Company, Detroit.

Among the department heads appear the names of P. D. Stubbs, director of sales; Homer McKee, director of advertising; P. W. Tracy, director of purchases and stores; Earl G. Gunn, chief engineer; F. P. Nehrbas, factory production manager, and Charles S. Crawford and J. L. Yarian, associate engineers.

All these men, both officers and department heads, are very well known in the industry and brief sketches of their careers have appeared in previous issues of this magazine.

According to the plans so far disclosed

the output of the new company will appear in large volume and the product will be of high quality.

DODGE BECOMES DAYTON CHIEF.

Garth A. Dodge, who for a number of years has been connected with the manufacturing and engineering departments of several large tire companies, has taken the position of chief engineer and factory manager of the Dayton Rubber Manufacturing Company, Dayton, O., maker of Dayton airless and Dayton pneumatic tires. Mr. Dodge is a member of the Society of Automobile Engineers, and is widely known in this country.

The company reports a large increase in business and the addition of equipment that allows the doubling of manufacturing capacity.

NATIONAL ENGAGES LEHMAN.

The National Motor Vehicle Company, Indianapolis, Ind., has engaged J. C. Lehman to assist T. J. Moore, the purchasing agent. Mr. Lehman will have the official title of assistant purchasing agent. Previous to this connection he was associated with the Saxon Motor Car Company in a similar capacity.

TO PROSECUTE TIPPING.

The Automobile Trades Association of New Jersey succeeded in having a bill passed through the last session of the legislature making it a misdemeanor, punishable by \$200 fine or six months' imprisonment, to give a chauffeur presents or tips when he buys supplies or places a car in a garage for storage, and imposing the same penalty on the chauffeur who asks for them. The association has circulated notices offering a reward of \$100 for information which will lead to the arrest or conviction of any person under the act.

Bryce E. Blackley, formerly New England division sales manager of the Chase Motor Truck Company of Syracuse, N. Y., will on May 1 become assistant to H. T. Boulden, general sales manager, at the home office. He will have direct charge of the dealers' aid department.

International Reports Net Profits of About \$700,000.

Annual Report Shows Gross Earnings of \$1,390,073 with Cash on Hand of \$108,891.

The International Motor Company, New York City, maker of Mack and Saurer trucks, shows by its annual report just issued net profits of \$661,118.98 for the year ended Dec. 31, 1915. Gross earnings were given as \$1,390,073.72, while operating and other expenses amounted to \$728,954.74.

The past year has been very profitable for the company, a large share of the business being due to the European war. On Jan. 1, 1913, the date for which the last report was issued, the company reported a deficit of about \$3,000,000, which, according to the annual statement for 1915, has been reduced to \$2,457,079.

At present the International company has outstanding \$3,600,000 in seven per cent. preferred stock and \$5,628,125 in common stock, as well as \$2,065,000 in series "C" bank notes. The balance sheet of the company is as follows:

Assets.	
Cash on hand.....	\$108,891
Accounts and notes receivable less reserve	643,799
Inventories	2,537,897
Investments	12,188
Real estate, plants and equipment, less reserve.....	904,974
Deferred charges	78,468
Licenses, patent rights and goodwill	6,153,266
Liabilities.	
Accounts and notes payable.....	\$594,248
Loans	396,050
Series "C" bank notes.....	2,065,000
Accrued interest thereon.....	288,223
Accruals, etc	144,987
Bond and mortgages of subsidiary companies.....	44,500
Special reserves.....	135,427
Preferred stock, 7 per cent.....	3,600,000
Common stock.....	5,628,125
Deficit	2,457,079

No predictions concerning the immediate future are made in the report, the officials of the company confining themselves to the statement that the present outlook is "good."

GREAT WESTERN FILES REPORT.

The Great Western Automobile Company, Peru, Ind., for which creditors recently petitioned a receiver, alleging insolvency, has filed a schedule showing assets of \$68,123 and liabilities of \$71,815. This was in response to the federal court ordering adjudication of the company's affairs.

WINTON RAISES PRICE \$200.

The Winton company announces that on and after May 1 the price of the Winton model 33 will be increased by \$200. This brings the price of the five-passenger car to \$2485. Advances in cost of materials and labor are responsible. Orders can be booked until May 1 at the old price. General Manager Churchill declares the company had thought to get through the season without an increase, but found it impossible.



Three Officials of the Premier Corporation: Left to Right, J. C. Flowers, President; Frank E. Smith and E. W. Steinhart, Vice Presidents.

Comparison of Capitalization and Production of Makers of Cars.

Indications Are That About 1,400,000 Cars Will Be Produced in This Country This Year.

The automobile season is now at its peak and notwithstanding the setback experienced through shortage of freight cars and the increased cost of raw materials, there is every indication that the total production of cars during 1916 will be about 1,400,000. The shipments for March were 28,600 carloads, as compared with 17,192 in the corresponding month of the preceding year. February's shipments were nearly double those of February, 1915.

More than 1,000,000 of these cars will be turned out by the "Big Six," the six larger automobile companies, which are the Ford, Willys-Overland, General Motors, Chevrolet, Studebaker and Maxwell companies. Emphasis is given to this prediction by the fact that the remaining 440 makers have in the majority of cases increased their production schedules.

The growth of the automobile industry has been phenomenal, as is shown in the stock markets and elsewhere. In nine years the output has increased from 60,000 to 1,400,000, which is a gain of 2300 per cent. The following schedule shows how the increase has been made annually:

1916.....1,400,000	1911..... 243,000
1915..... 700,000	1910..... 236,000
1914..... 515,000	1909..... 126,000
1913..... 430,000	1908..... 60,000
1912..... 378,000	

Considering the "Big Six" alone, the gross capitalization of these companies reached a total of \$216,185,643. This gives an average capital per car produced during 1916 of \$215, as compared with \$382 on the basis of the 1915 output. This decreased capitalization per car indicates a greater distribution of overhead expenses arising from capital requirements.

The huge profits earned in the automobile industry have been the sensation of the past two or three years. The secret of these profits has been quantity production, and how the six leading companies have been able to reduce the capitalization per car produced in the past year is shown in the following table:

	Total Capitalization	Cap. per 1916	Car Prod. 1915
Ford	\$50,000,000	\$100	\$158
Overland ...	36,000,000	180	263
Gen. Motors.	31,491,983	262	414
Chevrolet ...	20,000,000	210	1,000
Studebaker..	41,758,000	556	836
Maxwell	36,935,660	527	1,231

The figures for Willys-Overland, Studebaker and Chevrolet are for the calendar year, and for the others for the automobile year ending July 31. The capitalization per unit for 1915 for the Chevrolet company is based on the enlarged capital inaugurated in August of that year. The total capital of the

Studebaker company includes the harness and horse vehicle departments, which conduct about a fourth of the company's business.

GOODYEAR TIRE ISSUE SOLD.

It has been reported that the Goodyear Tire and Rubber Company, Akron, O., has sold nearly \$10,000,000 of its seven per cent. cumulative preferred stock to New York and Cleveland banking institutions. Against this issue the company agrees to set aside each year a sinking fund that will be sufficient to retire the whole issue in 23 years, and also to maintain net quick and total assets at not less than 115 and 200 per cent. respectively of outstanding preferred stock. The net quick assets of the company following the sale were reported as 154 per cent. on the preferred.

LIBERTY DENIES CONNECTION.

Officials of the Liberty Motor Car Company, Detroit, declare that there is no connection between that company and the R. C. H. Corporation. This statement is made to offset any impression that may have been gathered through the fact that the Liberty company has taken over the R. C. H. plant, the latter organization having moved to new quarters.

The Liberty company, of which Percy Owen is president, is a new concern. It is said it will produce a medium priced model which is understood to be of an entirely new type and designed to meet the requirements of those who demand a high grade vehicle.

NEW RUBBER AND TIRE COMPANY.

The American Rubber and Tire Company has been organized at Akron, O., and has purchased and succeeded to the business of the American Tire and Rubber Company. The personnel of the new organization includes the following experienced rubber men:

Fred H. Snyder, president; Charles Dietz, vice president; George W. Kratsch, secretary and treasurer; Henry L. Houk, general manager and assistant treasurer; J. W. Rock, factory manager.

This company manufactures a complete line of tire and tire accessories, including American Indian red tubes and vulcanizing cement. A two-story addition is being erected to give greater manufacturing facilities.

AUBURN ADVANCES PRICE.

The Auburn Automobile Company has increased the price of its model 6-38 from \$1050 to \$1085. The new rate went into effect April 1. Model 4-36, at \$895 and 6-40a, \$1375, remain the old prices for the present.

The Chalmers Motor Company has declared the regular quarterly dividend of 2½ per cent. on its common stock.

Half of Capital Stock of Perlman Rim Is Offered to Public.

Subscriptions Received Were Nearly Double of Amount Offered and Allotments Were Reduced.

Before the brokers opened the subscription lists for the 50,000 shares of the Perlman Rim Corporation which were offered to the public, the block of stock was greatly oversubscribed. The 50,000 shares represents half of the total, the balance being held by Messrs. Kaufman, Durant and Perlman, who jointly control the company. No par value has been placed on the stock, though subscriptions were being received at \$120 a share.

Under the plan of sale underwriters have the privilege of withdrawing half of their stock, which must be withheld from sale for six months. The company starts with capitalization of \$3,000,000 and will have no bonds or debts.

It is expected that the output will amount to 1,000,000 sets of rims within 90 days, and it is estimated on that basis that the earning power will be between \$2,500,000 and \$3,000,000 per annum.

The directors of the corporation are L. G. Kaufman, president of the Chatham and Phenix National Bank; W. C. Durant, president of the Chevrolet Motor Company; L. H. Perlman, L. B. Rosenberg, banker; Christian Grl, president of the Perfection Spring Company. The executive committee is composed of L. G. Kaufman, W. C. Durant and L. H. Perlman. Mr. Perlman is president of the company and Mr. Grl is vice president.

Negotiations for plants are under way. Ground has been broken for the enlargement of the Jackson Rim Company, Jackson, Mich., which the Perlman company has taken over, and agreements have been made for the entire capacity of the rim plant of the Mott Wheel Works, Utica, N. Y. A contract with the Willys-Overland company to supply its rim requirements for 30 days is being followed up with arrangements with other large car makers.

OVERLAND DECLARES DIVIDENDS.

The Willys-Overland Company, Toledo, O., has declared the regular quarterly dividend of 1½ per cent. on the common stock, payable May 1 to stock of record April 22. During the first week of April the company shipped 4460 cars.

MCFARLAN INCREASES PRICES.

The McFarlan Motor Company, Connersville, Ind., announces that after May 1 it will make touring cars of its Series X only and that the list price of these cars will be increased to \$3200. This step is reported as necessary because of the great increase in prices of materials.

RHODE ISLAND INCREASES TAX.

Portion of New Law Now Effective, Providing New Rates for Motor Trucks and Some Pleasure Cars.

Increase in the registration fee for motor trucks, certain types of pleasure cars and motorcycles, as provided for in the amendment to the automobile law passed during the last session of the Rhode Island General Assembly, became effective April 10. Other portions of the law will not become effective until Jan. 1, 1917, while that part that refers to issuance of markers will not go into operation until a year later.

One of the chief changes made concerns the adoption of a form of registration certificate which shall be good for the calendar year and the issuance annually of a different kind of marker. Another relates to the change in rates of license fees, which provides that the rate on motor trucks be based on tonnage rather than on horsepower as heretofore. The schedule ranges from \$7 for one ton to \$40 for 10-ton vehicles.

The rearranged pleasure car rates provide for a tax of \$5 on machines ranging from one to 15 horsepower and \$10 on those of from 15 to 30. On machines over 30 the old rate prevails. These new rates apply only on new registrations and old ones as they expire and the owner applies for a license.

Rates for dealers and manufacturers are based upon a graduated scale, a registration being issued at a minimum cost of \$25, allowing the use of five sets of number plates, and \$5 for each additional car registered. Under the old law the \$5 fee covered cars not exceeding 20 horsepower. Under the new regulation this class of vehicles is reduced to 15 horsepower.

Authority is given the state board of public roads, which has administration of the new law to place special restrictions concerning the type of motor power, horsepower, design and other features of the motor vehicle which the licensee may operate. This board also has authority to make rules and regulations regarding the lighting of motor vehicles, subject to the approval of the governor. The new act requires the display of lights during period of one-half hour before sunset and one-half hour before sunrise, instead of one hour in each case as under the old law.

MARYLAND'S MOTOR TRUCK BILL.

Motor truck owners in Maryland are aroused over a bill now before the state legislature, which they consider extremely radical and intended to force out of business those trucks operating on express schedules.

A great deal of trucking has been developed between cities in Maryland, the vehicles operating at set rates on regular schedules and competing to some extent with railroads. In the bill in question it is proposed to tax motor trucks on a ton-mile basis, which means that an ordinary five-ton vehicle driven 50 miles a

day would have to pay ton-mile taxes amounting to \$4125, in addition to the usual property assessment.

One provision is that truck wheels must not exceed a pressure upon the road of 500 pounds to the square inch. This, truck men say, is far too low, arguing that in other states the allowable pressure is from 750 to 1000 pounds to the inch. Horse drawn wagons, they claim, exert a greater pressure with their steel tires, but are not included in the bill's provisions.

ARMY CAR EN ROUTE TO COAST.

With the avowed purpose of spreading the gospel of preparedness from the Atlantic to the Pacific, William H. Forrest of Somerville, Mass., is now en route from his home city to California, in an armored automobile of his own fashioning. Mr. Forrest is a private in the Eighth Regiment of the Massachusetts Volunteer Militia, and the chassis of the car is of Reo make.

In preparing the car, which is to be shown in every city and town in which Mr. Forrest will stop, this militiaman had the advice and assistance of Lieut. W. H. Renwick, M. V. M. He took his own Reo the Fifth car and on it mounted the body shown in the accompanying illustration. The front is built so that one person can drive the car while a companion can fire from an automatic machine gun. In case of contact with enemy forces, a hood can be dropped to enclose the occupants, they then having vision through a periscope mounted in front. The section in the rear is arranged with space for another gun.

Wire barrier cutters, which have

proven so successful in European battlefields, run from the bumpers to the top of the driver's compartment. Indicative of the completeness of details is the axe carried in holders on the side of the machine.

The chassis weighs 2850 and the armor 1500 pounds additional, making a total of more than two tons. Each wheel is solid, weighing 165 pounds and carrying Lee armored tires. Rations for 10 days can be carried in the car.

Mr. Forrest is making the tour at his own expense, though he has the moral support of societies and individuals interested in American preparedness. He expects to be 112 days on the road and to travel along the Atlantic coast to Washington and then westward through Pittsburg, St. Louis and Denver to Los Angeles. The itinerary provides for return by the northern route.

ORDINANCE TO CATCH THIEVES.

An ordinance recently passed in San Francisco to aid in the apprehension of automobile thieves requires that all paint shops where motor cars are refinished must keep a record of the license and engine numbers of the machines on which work is done. In searching for a stolen car the police could look over these records and if a stolen car had been taken to a paint shop to have its appearance altered they could trace it readily.

ESTABLISHES "QUIET ZONES."

Quiet zones around hospitals in Boston, Mass., have been established by ordinance passed by the city council. This ordinance provides that when requested by the authorities of any hospital accommodating more than 50 persons, the commissioner of public works is required to erect as many signs as necessary and with the words: "Warning! Hospital! Make No Noise."



Armored Body Mounted on Chassis of Reo the Fifth in Which Massachusetts Militia Private Is Touring to the Pacific Coast to Preach the Gospel of Preparedness.

How Makers of Electrical Equipment Serve Owners of Cars and Commercial Trucks.



WHILE some manufacturers in the automobile industry and allied lines have for several years been offering to car owners that co-operation which has become generally known as "service," it is only within a comparatively short time that the practise has become almost universal and come to have a real meaning to motorists. Today the makers study and cater to the owner's interests and convenience and afford him the means of obtaining adjustments and repairs at minimum cost and equal to factory standards.

By service is meant that aid which the majority of manufacturers offer to users of their products to enable them to keep their cars and their equipment up to the highest operating efficiency. The channels by which this service is rendered may be through a liberal education in operation, maintenance and repair or by offering the benefits of a nearby company branch where equipment can be attended to by men who have had thorough factory training in their particular lines.

Among the makers of electrical starting and lighting and ignition equipment, service has been developed to an exceedingly high standard. As an instance of this there is the Splitdorf Electrical Company which maintains 21 service and distributing branches in various parts of the world. This vast organization is necessary because the company's product is used wherever gasoline engines are operated.

In a single decade this company has been developed from a small electrical concern to one of the greatest manufacturers in its field in this country. Starting in a small shop on 158th street, New York City, about 10 years ago, the company now has two large manufacturing plants and employs about 2800 work men and executives in its factories and branches. At about the time the automobile industry began its spectacular

growth, the company was moved to Newark, N. J. Its progress was consistent and rapid, and about four years ago negotiations were begun to absorb the Apple Electric Company, another big manufacturer of electrical equipment and located in Dayton, O. The combination of these two companies also included the Sumter Works, Sumter, S. C., which was known as the Sumter Electrical Company.

Volume of Splitdorf Business.

The Splitdorf company is now turning out electrical equipment for more than 35,000 automobiles every month, and the demand is increasing at such a rate that the company has been forced to begin the erection of additions at Newark that will afford 2½ more acres of floor space. This product includes Dixie magnetos for four, six, eight and 12-cylinder engines, Splitdorf-Apelco starting and lighting systems and Splitdorf Common Sense spark plugs and coils.

Producing electrical equipment for nearly 500,000 motor vehicles annually, naturally requires a vast and highly developed service organization to give adequate co-operation to users of that make of equipment. This organization has its ramifications throughout the United States, Canada, Europe and Australia. The American branches are in Boston, New York City, Newark, Philadelphia, Pittsburg, Atlanta, Cincinnati, Kansas

City, Chicago, Detroit, Minneapolis, Dallas, San Francisco, Oakland, Los Angeles, Seattle and Toronto. The foreign branches are situated in London, Paris, Milan and Melbourne.

The Splitdorf Electrical Company of Boston is typical of all others. It is both a service and distributing branch, serving the whole of New England, excepting that portion of Connecticut lying west of Hartford, which comes within the jurisdiction of the New York City branch. For the past two years it has been located in its present quarters at 1112 Boylston street, in the Fenway district of Boston, where it is really more accessible than if it were in the heart of the general business section.

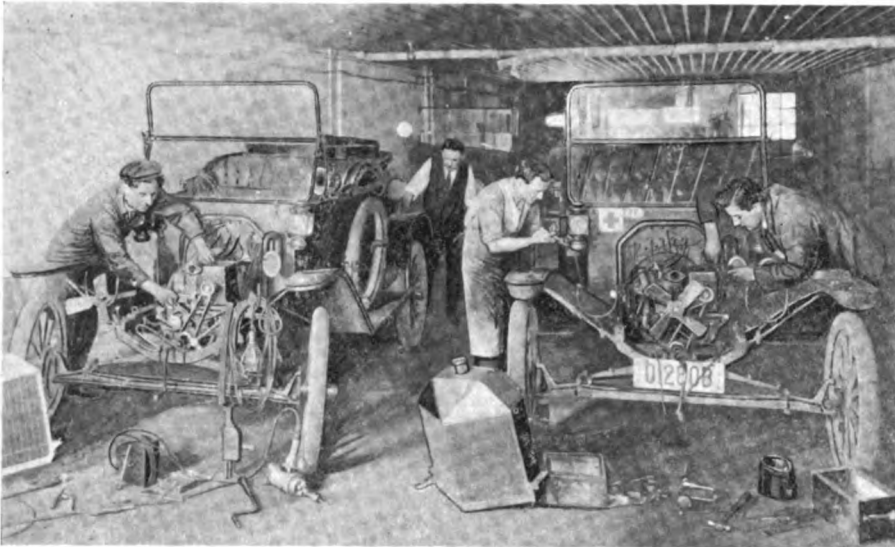
With this comparatively large territory to take care of, and especially in view of the large proportion of cars in New England that are provided with Splitdorf equipment in one form or another, the Boston branch is exceedingly busy. During a year's time its work men inspect, adjust and repair the electrical equipment of more than 5000 cars that are brought into the company's garage, while the men in the repair department handle an average of 3500 unmounted magnetos and 5000 coils. Aside from this the branch keeps three men constantly travelling throughout the territory among the garage and repair men to take care of Splitdorf distributing inter-

ests. Then, too, there is always an adequate stock of parts and supplies kept on hand for retail sale or for use in the repair departments.

Due to its strategic position and the able direction of its present manager, Robert M. Ellis, this station is one of the most important in the Splitdorf organization. Mr. Ellis has been with the Splitdorf interests for nine years, the last two of which have been spent in Boston as treasurer and manager of the company. He is widely acquainted in the New England automobile trade, having



A Corner of the Special Repair Department of the Splitdorf Company's Branch at Boston, Which Is One of the Most Important of the 21 Branches in Various Sections of the World.



A View of Part of the Garage, Which Has Accommodations for 10 Cars at One Time, and Where Work Men Overhaul and Install Splitdorf Electrical Equipment—Either Pleasure Cars or Commercial Trucks Are Handled Here.

travelled the territory while engaged in the supply business. It was while thus engaged that he was selected by the Splitdorf company as export manager of the New York branch, from which he was sent to Boston in 1914.

The plant has been departmentized in a manner that assures prompt and highly satisfactory service. The first or main floor is occupied by the sales room and general offices, the private office of the manager, a general stock room and the repair department. Facing Boylston street is a spacious show window which is fashioned to lend itself to striking displays of Splitdorf products. The basement is taken up by the garage, which has capacity for 10 cars, and is reached either from Massachusetts avenue or Hemingway street.

Boston Branch Completely Equipped.

The branch is completely equipped with facilities to give the same quality of service as could be obtained at the factory, and in much less time for the patrons in its territory. In the sales department a car owner, garage or repair man can purchase complete new Splitdorf ignition and starting and lighting systems, as well as spark plugs, and have them installed immediately by the work men in the repair department. New parts can be obtained from stock or old parts can be restored to perfect working condition without appreciable loss of time. Or if desired the company will loan a customer the parts necessary to keep his car in service while this equipment is being adjusted or repaired. This is a feature that will appeal to all busy car owners.

The free service offered by the company embraces the work done on systems that are inoperative through defective workmanship or material. Of course a reasonable charge is made for repairing a system that is faulty through abuse by the operator. The free service is in force during the life of the guarantee issued by the Splitdorf company, which is for one year from date of manufacture. The scope of the work done includes every repair and adjustment

that may be needed, excepting the re-winding of armatures, which is done at the Newark factory.

When equipment is received either by express or is delivered at the branch, it is dismantled and cleansed of dirt and grease. Then it goes to the special repair department, where it is thoroughly overhauled and restored to perfect working condition. Before it is considered satisfactory it must pass a rigid test by the special testing apparatus shown in one of the accompanying illustrations.

This apparatus is very interesting and is constructed so that it is possible to test both new and old models of Splitdorf and Apple systems. Beneath the table is a variable speed motor which drives a countershaft by belt, and from this countershaft is driven the pulley of a generator test block, of a magneto test block and of a low tension (master) magneto.

The generator block is adjustable to

allow for various sizes of sprockets and bases, and the switchboard carries switches to control the circuits to the cutouts and meters for the different types of instruments that may be tested. On this block generators are tested especially for voltage at low speed and for amperage charge rate at all speeds, which is of particular importance. The regulation is taken care of by the three-brush arrangement instead of four, as commonly used on four-pole instruments. The starters are tested for horsepower by the brake test method.

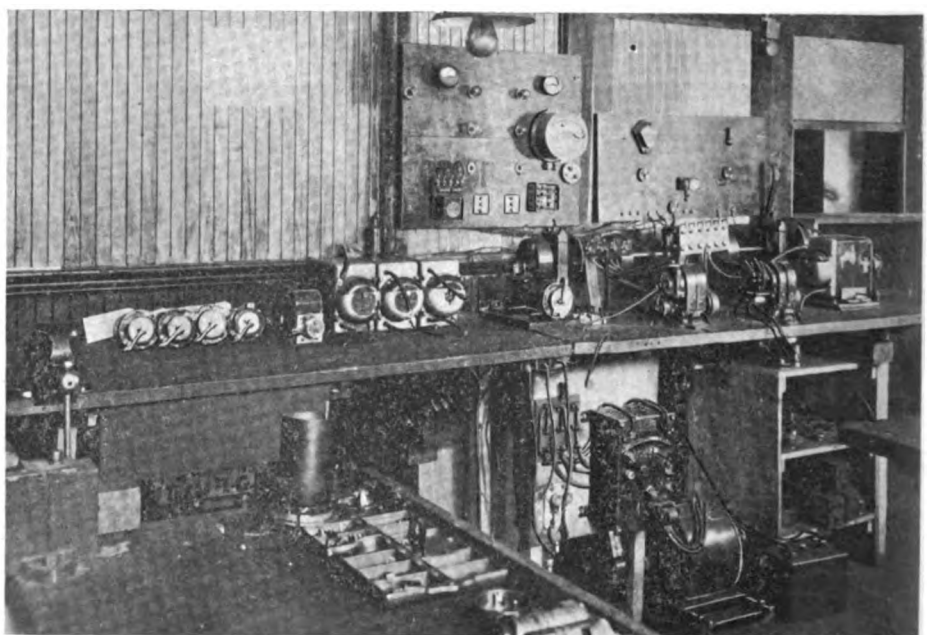
Other Testing Apparatus.

The magneto block is adjustable to compensate for various styles of couplings and special bases used on the different makes of cars equipped with Splitdorf equipment. From one to 12-cylinder magnetos can be tested on this block.

The low tension (master) magneto is used to test all transformers, which are also tried out in connection with a battery to show sparks on four spark plugs mounted on a panel, the gap at the electrodes being about 5/16 of an inch. Low tension magnetos are tested by being connected up with a (master) transformer, showing the sparks on a 12-plug panel.

High-tension magnetos and generators are tested similarly, except that no coil is used. These receive extraordinarily rigid tests, one being for spark to jump a gap of 5/16 of an inch, which is equivalent to about 85 pounds compression with a 1/32 of inch gap at low engine speed. High speed and safety gap tests are also made.

Vibrating coils, condensers high and low-tension armatures, high-tension windings, direct current armatures, field windings and magnetos are tested separately on another test table, which is equipped with volt meter, milli volt meter, ammeter, milli ammeter, farad-meter and magnet meter.



The Special Testing Apparatus in the Repair Department by Which Both Old and New Models of Splitdorf and Apple Systems Can Be Tested—This Is One of the Most Interesting and Important Parts of the Station's Equipment.

There are about 40 different makes of vehicles equipped with Splitdorf-Dixie ignition systems as standard equipment.



Robert M. Ellis, Manager and Treasurer of the Splitdorf Electrical Company of Boston.

There are about 15 car manufacturers who employ Splitdorf Apeldo starting and lighting systems as standard and 20 who use the Splitdorf Common Sense spark plugs.

Garage Has Ample Accommodations.

The garage in the basement is set aside solely for the convenience of those patrons who bring in their cars to have the electrical equipment attended to. Ten cars can be accommodated at one time. It is not essential that either the car or the dismantled equipment be brought to the service station, though it is desired, for the company is prepared to send one or more of its experts to any point within the New England territory.

Customers are afforded full protection in the matter of charges, time of delivery, etc., through there being a comprehensive tag system in use. Each car, magneto and coil received is immediately "tagged" with a card which shows the customer's name and address, the date received and date of delivery and time promised, the number of the coil or magneto and the number and name of the car, and what is to be done to the component or equipment. Each tag is given a serial number, and on the back has space for the recording of the parts and supplies used, such as brushes, platinum screws and rivets, rollers and pins, etc., and a space for the number of hours of labor expended. When the job is completed these cards are filed away so that at any time during the ensuing two years they can be produced to show just what was done on a particular job.

In general features this description of the Boston company applies to all other Splitdorf branches, and is illustrative of the scope of the Splitdorf Electrical company's endeavor to afford high-grade service to every user of its equipment. By having these service stations in strategic positions in all parts of the country, the parent company is able to

devote its entire attention to the production of the thousands of sets of equipment which are in demand by car manufacturers. From the car owner's standpoint the opportunity to send equipment to a nearby Splitdorf branch to be overhauled and adjusted by expert work men insures high-grade workmanship at minimum cost of time and money.

SLEEVE VALVE ECONOMICAL.

The high price of gasoline is leading Willys-Overland company to lay greater emphasis on fuel economy of the sleeve valve motor of the Willys-Knight car. The engine has other advantages: Freedom from repairs, improved power with use, positive action of the valves and smooth running. Because most Knight motored cars have been high priced cars whose owners were not greatly interested in gasoline consumption economy has been overlooked. But records of the Willys-Knight have proved that due to its perfect compression and smooth valve action, it gets greater power from the same amount of gasoline than other engines.

CLIMBS ANOTHER MOUNTAIN.

After having made a record climbing Lookout mountain, Colorado, on high gear in his King Eight, T. P. Chase, chief engineer of the King Motor Car Company, recently did the same thing at Lookout mountain, California. He went to the Pacific Coast to rest and tried his car on all the hard hills in the vicinity of Los Angeles, including the Grand street hill in that city, which he climbed on high, stopped his car in the middle of the hill, and went up the rest of the distance on the same gear.

Such trips are excellent for engineers, since they give them an insight into what the public in various sections requires

in a motor car. Mr. Chase thinks the western slope of the Rocky mountains is the country's best testing ground for experimental cars.

NEW BASIS FOR INSURANCE.

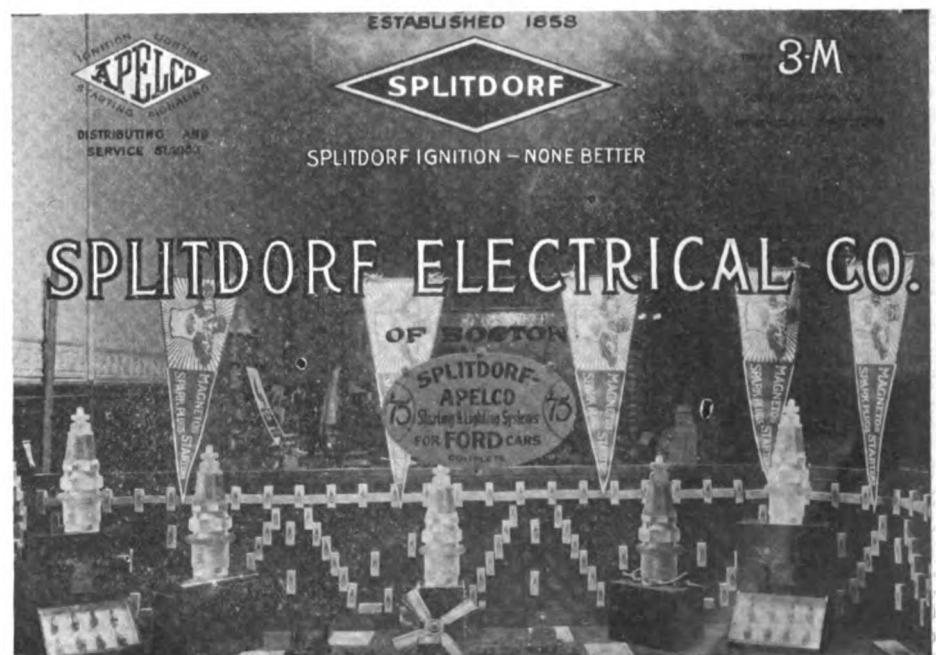
One of the leading insurance companies located in New Jersey has established the weight of the car as a basis for insurance rates. Cars that weigh less than 3000 pounds are insured at a rate that is less than for those over that weight. Analysis of the schedules shows that cars in the first classification are considered by the company to be about 1½ times a better risk than cars under the second classification.

ORPHAN CARS IN MINNESOTA.

Registration lists in Minnesota for 1915 are said to disclose the fact that 75 per cent. of the cars owned in that state are "orphans"—cars made by companies that have since gone out of business. This condition the Studebaker corporation believes is producing a tendency on the part of car buyers to look more carefully to the financial standing of the manufacturer and to make it easier for the large and soundly established manufacturer to sell his cars.

\$480,000 FOR CONNECTICUT.

The state automobile department of Connecticut reports the receipts from licenses and sales of markers for the first four months of this year to be \$480,145, which is in excess by about \$125,000 of the amount received during the corresponding period of 1915. The number of pleasure cars registered last year was 34,000, and present indications are that there will be more than 40,000 this year.



A Striking Display in the Branch's Spacious Show Window, Which Faces Boylston Street—In the Background Can Be Seen a Part of the Salesroom and the Front Partition of the Manager's Private Office.



A large Rhode Island repair shop in which the repair department is on the second floor, utilizes the arrangement shown in Fig. 174 for carrying the exhaust gases from machines to the open air. It consists of a large pipe arranged along the wall at one side of the room. Both ends of the pipe are open, one extending out at the rear of the building and the other terminating close to the wall inside the room. At the indoor open end is an electric fan such as is used for ordinary cooling purposes. This is connected with an electric light socket. Connectors are placed in the large pipe at equal distances and to these are attached flexible metal tubings which are of sufficient length and diameter to slip over the short pipe that extends from the ordinary exhaust muffler. Small hooks are inserted in the ends of the tubings so that they may be clamped to the muffler by ordinary coil springs.

The operation is simple. The car is placed so that rear is nearest the wall and the flexible tubing is then clamped to the muffler. When it is necessary to test the motor, the fan at the end of the large pipe is started. The exhaust gases from the machine are carried through the muffler, through the flexible metal tubing and from there to the large pipe, and the air pressure generated by the fan then forces them into the air outside the building. When only one car is being tested, the openings in the flexible tubings not being used should be plugged to prevent the exhaust gases from entering the room by that avenue. With this arrangement it is possible to conduct a test of several hours duration and also use excess oil without any smoke.

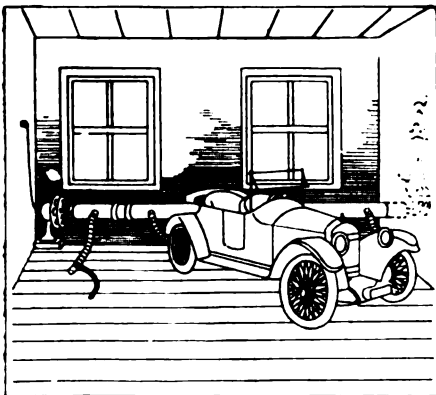


Fig. 174—Method of Preventing Exhaust Gases from Filling the Garage.

ADJUSTING VIBRATING COILS.

Some of the new models, as well as many of the earlier types of cars are equipped with vibrating coils. To adjust these components it is not necessary to turn the motor over slowly until a contact is made at the commutator so that the vibrator will buzz. The tuning may be easily accomplished as shown in Fig. 175. The method consists of attaching one end of a wire to any metal part of the car, such as the steering column, and placing the other end on the adjusting screw. When battery ignition is used the vibrator will buzz as long as the contact remains. Each unit should be tested in a similar manner. The sugges-

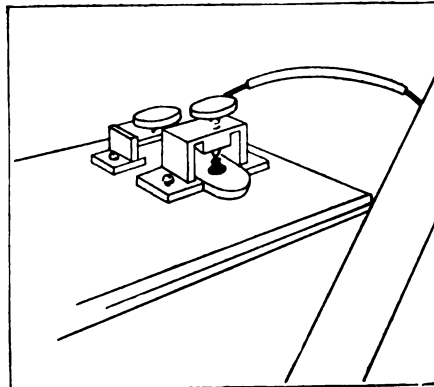


Fig. 175—A Cable Contacting at One End with the Adjusting Screw and the Other End with the Steering Column Will Cause the Vibrator to Buzz.

tion will also prove helpful for testing spark plugs when this type of ignition is used.

STRETCHING VALVE SPRINGS.

Frequently the clattering sound in the valve mechanism is due to one or more weak valve springs. This condition would also cause uneven motor operation, as there would be no positive action of the valves. Of course the proper remedy is to replace the weak springs with new ones but if these are not handy or the owner does not wish to meet the necessary expense, the only alternative is to renovate the old ones. This may be done by removing and stretching them, by securing one end in a vise and tying a cord to the other. Care should be taken not to stretch the springs to the extent that they lose their shape or to a point where they will close the valve with so much

force as to do it injury. A stiff valve spring also causes extra consumption of power. Another method of increasing the strength is to insert washers under the lower end.

REMOVING FROZEN TIRES.

Although car manufacturers often advise the removal of the shoes and the cleaning of the rims at regular intervals, this work is frequently neglected by the average motorist. When the shoe has been in continuous service for 2000 to 4000 miles and operated over wet and muddy roads, the task of removing it from the rim is apt to be difficult. The tool shown in Fig. 176A will greatly assist the operation when the condition stated above prevails. It consists of two hinged jaws operated by a threaded bolt and nut.

Two small wooden blocks, each being about three inches in length, are placed on either side of the deflated shoe and close to the rim. The jaws are placed behind the blocks and slowly compressed. The action gradually forces the bead of the shoe away from the metal so as to permit the insertion of the tire tool.

Having forced away one section, remove the tool and place one of the wooden blocks against the part of the tire still adhering, as illustrated at B. By striking it several sharp blows with a hammer, the part will gradually peel away from the rim. It is imperative that there be no sharp corners on the wooden blocks, as these are apt to cut into the rubber. Before replacing the tire, clean the rim and smear with graphite.

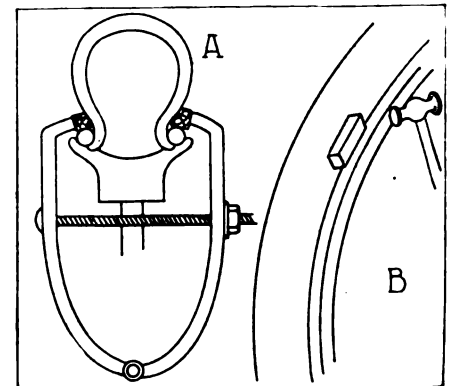


Fig. 176—A, Easily Constructed Tool Forces "Frozen" Tire Away from Rim; B, Wooden Block and Hammer Assist Operation.

EASILY MADE FOOT RAIL.

Foot rails are of great service to the passengers in the tonneau when riding over rough roads, because they provide

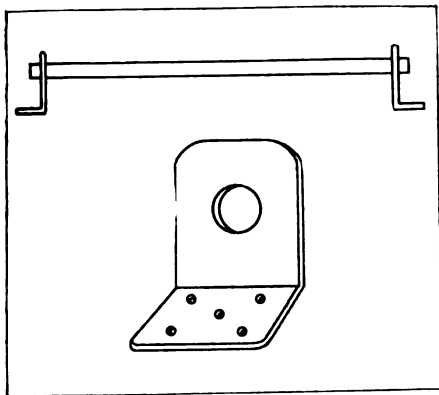


Fig. 177—Parts of Home-Made Foot Rail Which Affords a Brace for Passengers' Feet.

a brace for the feet. Foot rails are not expensive when purchased ready made, but they may also be easily home made at slight cost. In Fig. 177 is shown a foot rail made from a heavy gauge brass tubing, about one inch in diameter, which was purchased from a brass supply house. The brackets were made of heavy brass plate, which were drilled to the same outside diameter as the tubing. They were next bent in a vise to the shape shown. Holes were also drilled and countersunk for small wood screws, after which the tubing was inserted through the large apertures. The extended ends of the tubing were enlarged so that it could not work out of the brackets. The rail was then screwed to the floor of the tonneau in the desired position. One bracket should first be securely attached to the floor and the other should be moved along the tubing until it binds before securing.

RUBBER CEMENT.

A simple formula for making rubber cement is as follows: Thoroughly mix eight fluid ounces of carbon bisulphide and 40 grains of rosin. To this mixture add one ounce of old rubber which has been cut into fine strips. The rosin and carbon bisulphide can be purchased at any chemists, while the rubber can be cut from the tread of a discarded tire or old inner tube. The only objectionable feature of this cement is the disagreeable odor, due to the presence of the carbon bisulphide.

VALVE RACK.

Because it is essential that valves be replaced in the seats from which they were removed during the overhaul of the engine, it is customary to place them on the work bench in the order of their removal. If they remain out of the motor for any length of time this system is not satisfactory because the order is apt to be disarranged, the faces of valves scratched, or some of the parts lost.

A much better plan is shown in Fig. 178. It consists of an ordinary wooden rack, which may be made a permanent

fixture to the work bench or portable as desired. All that is required is the drilling of 24 holes, 12 in each row, to allow the insertion of the valve stems. One row is marked exhaust and the other intake. The openings in each row are marked from 1 to 12, each of these figures corresponding to the number of the cylinder from which each valve was taken. A rack of this type prevents complication, injury to faces and loss.

STOP FOR CAR.

A motorist who stored his car in a poorly lighted barn evolved the practical device illustrated in Fig. 179 (left) to prevent injury to the rear of the car when backing into the building. He bolted together two 3x4-inch joists and then secured them to the floor within a suitable distance of the wall. When backing the car to its position, should the driver misjudge the distance or the brakes refuse to hold, the car will be stopped without contacting with the wall by the joists, which are six inches in height.

Another motorist, who stores his car in a private garage, where space is lim-

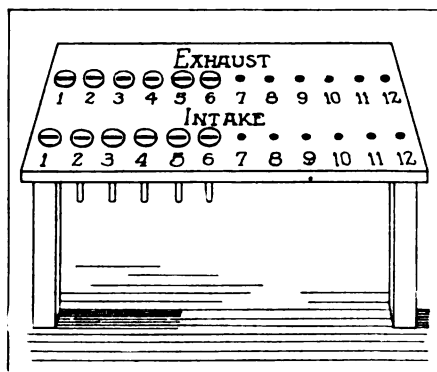


Fig. 178—Stand Prevents Disarrangement of Valves When Out of Motor.

ited, has arranged joists similar to the ones described above on both sides and at the rear of the building. These are arranged at the desired distance from the falls as shown in Fig. 179 (right). When backing car in the joists serve as a guide and it is impossible for the rear of the car to strike the side or rear walls. By painting these joists white, the driver is easily guided to his position at night.

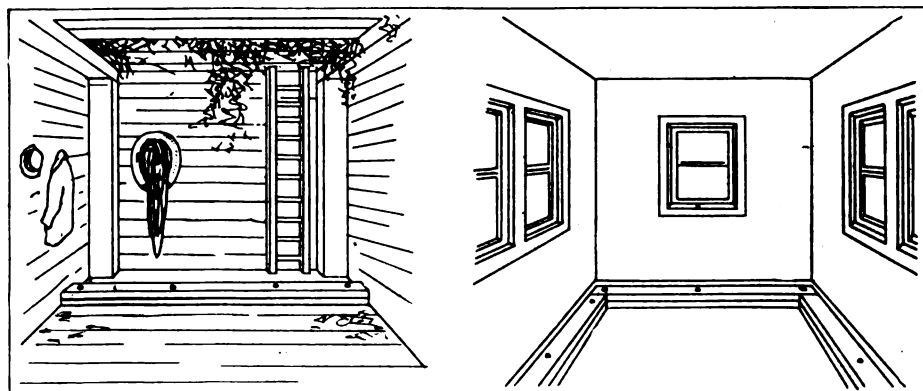


Fig. 179—Joists Prevent Car Being Backed Into Wall (Left), Joist Guides Prevent Car Contacting with Side or Rear Walls of Garage (Right).

S. A. E. HORSEPOWER FORMULA.

The standard formula for computing the horsepower of the gasoline engine in this country is the one adopted by the Society of Automobile Engineers. The National Automobile Chamber of Commerce has also adopted it and it is now also known as the N. A. C. C. formula, it consists of squaring the bore multiplying by the number of cylinders and dividing by 2.5.

The accompanying table will be of service in rapidly ascertaining the horsepower of four and six-cylinder motors, the bore being stated in both inches and millimeters.

Bore		Horsepower	
Inches	Millimeters	4-Cylinder	6-Cylinder
2.500	64	10.000	15.0000
2.625	68	11.000	16.5000
2.750	70	12.100	18.2000
2.875	73	13.250	19.8750
3.000	76	14.400	21.6000
3.125	79	15.625	23.4375
3.250	83	16.900	25.4000
3.375	85	18.250	27.4000
3.500	89	19.600	29.4000
3.625	92	20.250	31.6000
3.750	95	22.500	33.7500
3.875	99	24.000	36.0625
4.000	102	25.600	38.4000
4.125	105	27.250	40.9000
4.250	108	28.900	43.8000
4.375	111	30.625	45.9375
4.500	114	32.400	48.6000
4.625	118	34.350	51.6000
4.750	121	36.100	54.1000
4.875	124	38.000	57.0000
5.000	127	40.000	60.0000
5.125	130	42.000	63.0000
5.250	133	44.100	66.2000
5.375	137	46.000	69.1000
5.500	140	48.400	72.6000
5.625	143	50.625	75.9375
5.750	146	53.000	79.5000
5.875	149	55.250	82.9000
6.000	152	57.600	86.4000

IRON AND STEEL TEST.

To ascertain whether a pipe is made of steel or iron, cut off a short piece and suspend it in a solution consisting of nine parts water, three parts sulphuric acid and one part hydrochloric acid. This solution should be placed in a porcelain or glass vessel and the part should be suspended so that it does not touch bottom. After two or three hours' immersion, remove and rinse off the acid. If it is a steel pipe, the surface will be bright, solid and unbroken. On the other hand, if the pipe be of iron the surface will show faint ridges or rings, denoting the different layers of iron.

I'm sorry for the man who hasn't a Pyrene on his car

My first car caught fire and in twenty minutes it was a ruin—a skeleton.

I didn't know about Pyrene then. I didn't know it would put a fire out—quick. I didn't know it would save me 15% on my car insurance.

I didn't know that a carburetor—the very lungs of a car—could catch fire. I didn't know gasoline flames could spread so quickly.

George was at the wheel. The Mrs. and I were in the tonneau. There was a "back fire." Ten seconds later the flames were sticking their tongues through the bonnet, and out of the radiator cells.

My wife screamed and jumped through the door, and I followed. George shut the engine down and made one leap for the road.

He ran toward a neighboring farmhouse—a quarter of a mile away—for water. The Mrs. and I threw handfuls of dirt on the flames. It was hopeless.

We stood by the roadside—she in tears, and I beholding my prized possession melting away almost like butter over a hot stove.

It was a car we loved.

I don't think we'll ever get another so good.

Then just as a rag of the top, the last thing to blaze up, had passed into ashes, came George tugging his pail of water.

I have a new car now. It is Pyrene equipped.

For I've seen since then more than one good car saved by a few pumps of Pyrene. The 15% I saved now on my insurance more than makes up for the \$7.50 investment in Pyrene.

But I'm sorry for the man who hasn't a Pyrene on his car.

My advice is: Go buy one today.

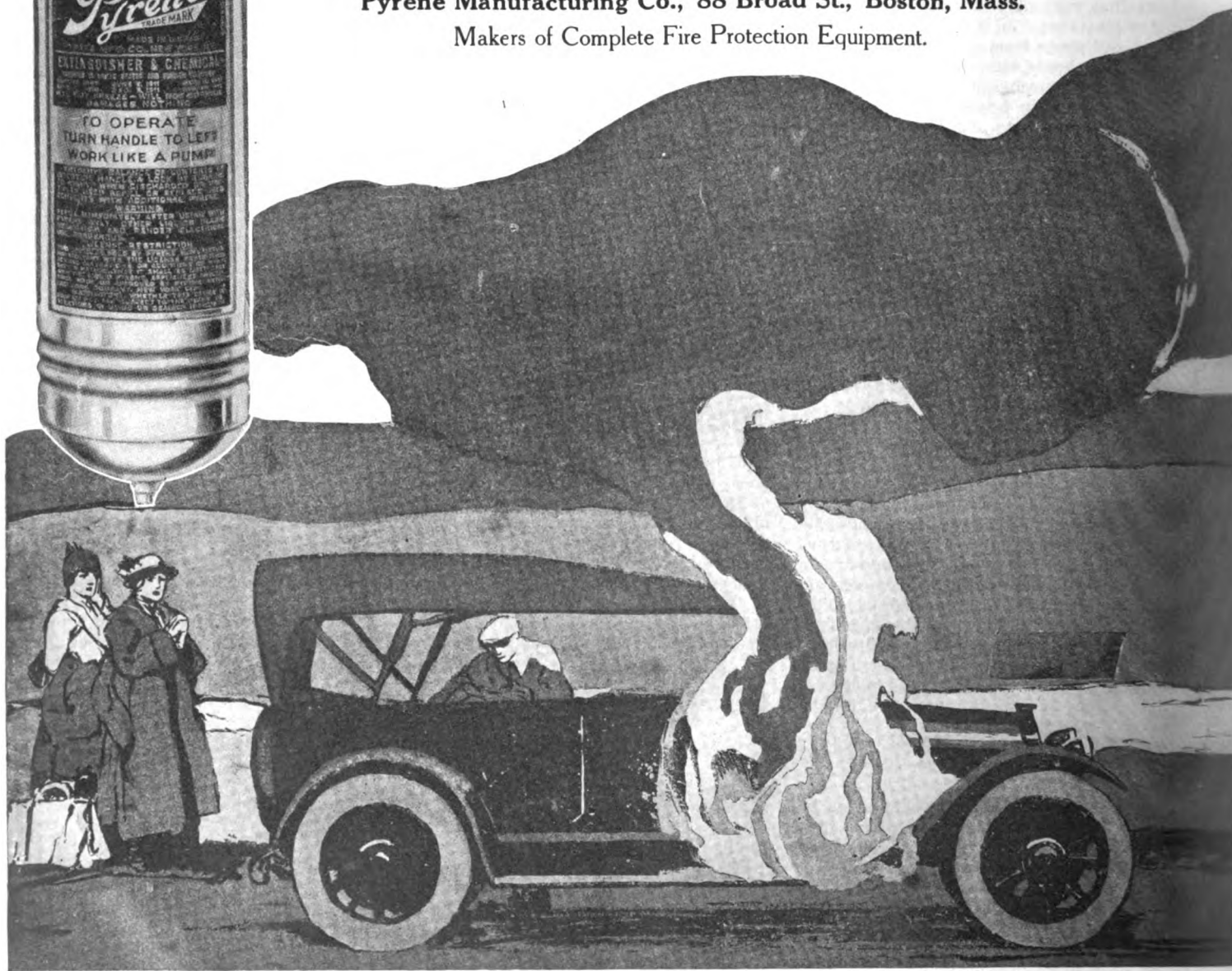
800,000 in use—Sold by hardware and auto supply dealers—\$7.50 complete with automobile bracket.

Write to the Pyrene Co. for an interesting booklet "Fire Fotos."

Inspected, approved, and labeled by the Underwriters' Laboratories Inc.

Pyrene Manufacturing Co., 88 Broad St., Boston, Mass.

Makers of Complete Fire Protection Equipment.





The graphic features a central oval with the word "Pyrene" in a stylized script, followed by "FIRE EXTINGUISHERS" in bold capital letters. To the left, a man in a suit is running towards a burning car, with the text "Pyrene WOULD HAVE SAVED HIS CAR" below. To the right, a man is standing next to a car, with the text "Pyrene REDUCES HIS INSURANCE 15% EACH YEAR" above him.

15,000 merchants are showing this display today in their windows. It is your reminder to stop—go in—and buy a Pyrene



(When Writing to Advertisers, Please Mention The Automobile Journal.)

INDIANAPOLIS RACE PROSPECTS.

English Car and Belgian Driver Scheduled to Appear in Speedway Contest on Memorial Day.

For the first time in the history of American speedway races, three brothers, all members of the same team, will appear together in a motor contest. They are Louis, Arthur and Gaston Chevrolet, who have built three Frontenac racing cars in which they will compete for the big prizes at the Indianapolis speedway on Memorial Day.

Louis is now the only survivor of the famous Buick team which was very celebrated several years ago. Louis Strang, another Buick driver has been dead for several years. Burman, the third team member, recently met the fate of the chronic race driver.

A car that will attract much attention from engineers who attend the race will be the English Sunbeam Six, driven by Joseph Christaens, a Belgian. This car is a new product of the Sunbeam company and incorporates features that have been developed through the work of the company on aeroplane motors for the war. This experience is expected to have important results for automobile motor design. There are four valves to each cylinder and the car is said to have been driven 120 miles an hour at the Brooklands track.

Christaens appeared in the Indianapolis race two years ago, as the driver of the Sun-Excelsior, a Belgian car. He has been in the aviation service and is one of the most daring and capable of European drivers. He has appeared in the Grand Prix.

GOING TO SHEEPSHEAD BAY.

The important racing events of the early spring on the Pacific Coast have all been run and the prominent drivers who took part in them are on their way to compete on the eastern speedways. Entrants have been very prompt in filing their entries for the early contests.

When the Sheepshead Bay speedway opens May 13, when the Metropolitan trophy for \$15000 will be the leading event, all of the best known drivers will be there. These will include Pullen, Cooper, Wilcox, Alley, Chevrolet, De Palma, Oldfield, Resta, Aiken and Mulford.

Resta has returned from a trip to Europe, where he went to get parts with which to rebuild his Peugeot car, and he hopes to have his blue racer in excellent condition. He is enthusiastic over the idea of having a number of short events instead of one long one, as it will give the drivers several chances to win and will enable them to make slight repairs and enter later races if they are forced out of the early ones. Resta is more famous for high speed than for winning long races, as the speed at which he goes often effects his car before the end of the run.

DRAG CARS ON SLEDGES.

A load of Overland automobiles was dragged on sledges from Montpelier, Idaho, to Afton, Wyoming, a distance of 50 miles, in order to prepare for the spring rush of buyers at the dealer's establishment there. Afton is a long distance from the railroads and the nearest station is Montpelier. Mountains where one heavy snow piles on top of another must be crossed. The only means of transportation is by sleds.

TO CROSS CONTINENT ON HIGH.

The Pathfinder company is planning a transcontinental trip for its 12-cylinder Pathfinder the Great over the Lincoln highway, with second and third speeds removed and only high and reverse in the gear box. Arrangements are sought

to have this run terminate at the San Diego fair instead of at San Francisco, as was at first suggested. Efforts will be made to secure reliable witnesses all along the route to report the performance of the car so that there can be no doubt as to its success in difficult going. The arrival of the car at San Diego is expected to be one of the motor events of the exposition.

FRESNO TO HAVE 300-MILE RACE.

A 300-mile motor race will be held at Fresno, Cal., in celebration of Raisin Day, April 29. The course is 14 miles long, with two six-mile straightaways and a connected road of one mile at each end. Sanction has been requested from the A. A. A. The Raisin Classic Motor Cup Holding Company is making the arrangements and expects to offer \$10,000 in prizes.

HUPP TO USE DIXIE MAGNETO.

Following several recent announcements of the adoption of Splittorf electrical equipment by prominent car manufacturers, comes the statement by the Splittorf Electrical Company, Newark, N. J., that it has just closed a contract with the Hupp Motor Car Corporation for its magneto requirements for 1917 on all automobiles for export. The Dixie 40 magneto will be used.

VENEZUELA BUYS CARS.

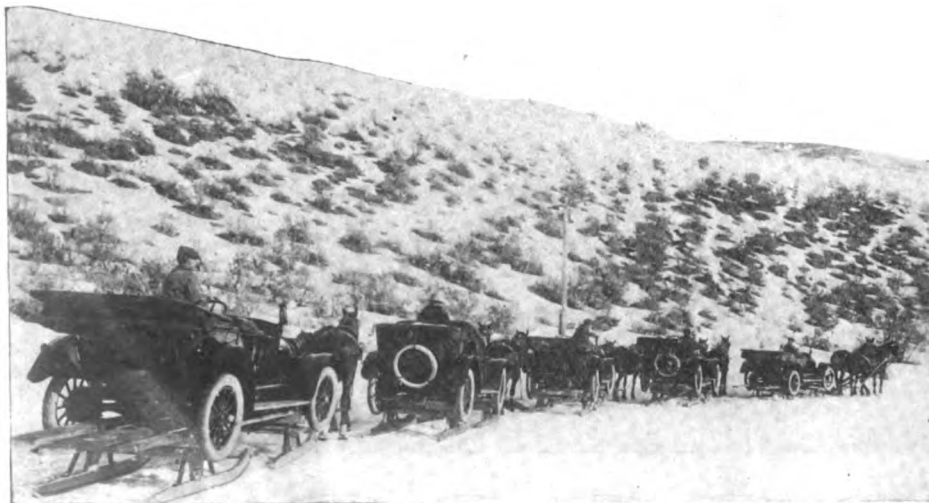
Venezuela has been importing a great number of motor cars since 1912 and those bought in the United States exceed in number those from all other countries. In the fiscal year ending June, 1915, commercial cars, valued at \$7164 were received, while there were 227 passenger cars, valued at \$143,086. Almost every steamer from New York brings in from five to a dozen cars at Caracas.

There are many places in the country which it will never be practicable to reach by railroad. Good wagon roads are being constructed rapidly so trucks and passenger cars can be used. Gasoline is still imported in cans and for that reason the normal price ranges around 50 cents a gallon.

The government wishes to encourage the use of motor cars and therefore assesses the lowest rate of duty upon them. This amounts to 68 cents per 100 pounds. There is intense interest in motor vehicles and nearly every day the papers print telegrams from various towns announcing the first appearance of a motor car.

BARS NON-RESIDENT DRIVERS.

Jitney drivers cannot secure licenses to ply their trade in Springfield, Mass., unless they live there or are employed by a Springfield company. This regulation, which has been promulgated by Chief of Police Quilty, is intended to check the invasion of jitney drivers from neighboring cities from which Springfield suffered last summer.



A Shipment of Overland Cars Being Transported on Sledges from Montpelier, Idaho, to Afton, Wyoming, Through Mountain Passes Filled with Snow.

SUGGESTIONS FOR THE FORD CAR OWNER.

Removing the Timing Gear and the Camshaft, Learning the Condition of the Bearings, and the Wear of the Valve Tappets—Methods of Restoring Efficiency.

The 46th article dealing with the operation, construction, maintenance, care and repair of the model T Ford chassis is the seventh of the series devoted to adjustment, restoration and overhauling.

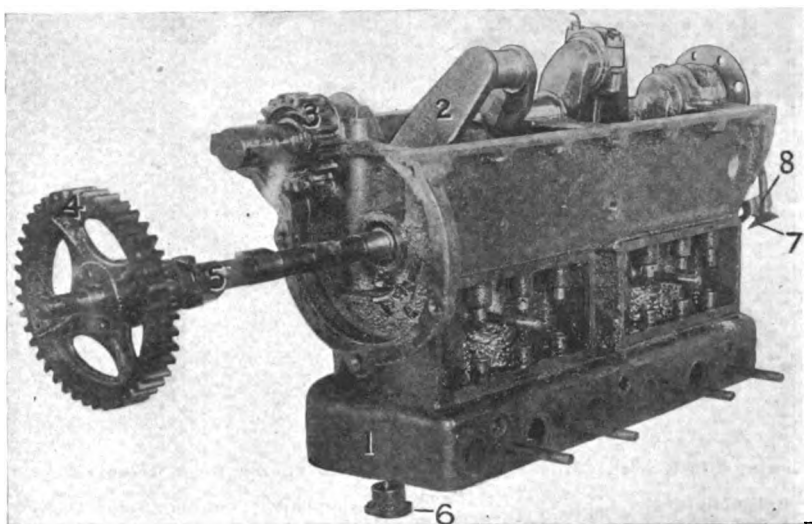
PROBABLY very few owners of Ford cars understand the necessity of having the oil tube cleared. The lubricant is carried upward by the centrifugal action of the flywheel and drains into the funnel of the tube. The volume of oil that is circulated depends upon the depth in the reservoir and the freedom of the flow through the tube. The tube is comparatively small, although it is adequate when it is not in any manner obstructed, but the natural tendency of any foreign matter carried into the tube is to reach the outlet.

The main flow is, of course, into the timing gearset, and if this is free the drainage is back through the oil troughs in the base of the engine case. If this flow is not normal the lubricant in the troughs is not sufficient to have satisfactory distribution through the interior of the engine, and, of course, the cylinders will not be lubricated. If the oil is protected from dust and dirt and care is taken to have the containers or measures clean, there ought to be comparatively little foreign matter carried into the engine base. But the bands that encircle the drums of the transmission gearset are lined with a fabric impregnated with a composition that is not affected by the oil, and with use particles of the fabric are worn off and remain in the oil.

These will generally be precipitated to the bottom of the oil reservoir, but they are sometimes carried upward with the oil into the tube, and if these particles accumulate, in time the tube may become obstructed. These may be removed by withdrawing the tube and cleaning it, and when the engine is being overhauled care should be taken to remove the tube and see that it is free and clear. When one notes the position of the oil tube the inclination forward is seen to be comparatively slight, and there is practically no gravity head in the tube because of the very small size of the funnel and the short length to the turn.

Because of the necessity of the magnets hav-

ing clearance of the field coils that may range from $1/32$ to $1/50$ of an inch, the funnel of the oil tube is simply an expansion of one end, and, of course, no form of filter can be utilized, though such a device would be very useful and would serve an excellent purpose. With rare exceptions in all lubricating systems in which the oil is drawn from the reservoir, it is pumped through a screen, but this could not be possible with the Ford construction. Because of the manner of attaching and the location the oil tube is not easily reached, and only when the engine has been dismantled can it be examined thoroughly and made perfectly efficient. Of course frequent removal of the drainage plug in the base of the flywheel housing and the cleaning of the sedi-



Engine Block with Camshaft Partially Withdrawn from the Bearings.

- 1—Cylinder Block.
- 2—Crankshaft.
- 3—Crankshaft Timing Gear.
- 4—Camshaft Timing Gear.

- 5—Camshaft.
- 6—Camshaft Timing Gear Lock Nut.
- 7—Oil Tube.
- 8—Oil Tube Clamp.

ment pocket, which had best be done after the machine has been standing over night, which will insure precipitation, is a judicious precaution. One can understand that when the flywheel is revolving 1500 times a minute in a pocket containing from two to four quarts of oil there is very little probability of anything not of considerable weight remaining at the base. The flywheel has clearance of not more than an eighth inch of the engine case and the oil is more violently agitated than might be conceived. As a matter of fact a considerable part of what is in the reservoir is distributed on all the internal surfaces during the time the engine is running.

The Camshaft Assembly.

The camshaft is the next component to re-

ceive attention. The timer arm, which is carried on the forward end of the camshaft, is secured by a nut and a locking clamp or device. The timer arm is seated on a taper extension of the camshaft. Back of this the shaft is threaded for a heavy nut that secures the camshaft or timing gear against the flange of the camshaft. The timing gearset, which consists of the pinion on the crankshaft and the gear on the camshaft, is enclosed in a housing formed by an extension of the engine block on which is placed a cover that is secured by five cap screws.

After the locking device has been removed and the retaining nut taken off, the timer arm can be loosened. The five cap screws that retain the cover plate must be taken out and the plate can be removed with a putty knife or a screw driver. As there is a paper gasket between the plate and the engine block, care should be taken to prevent damaging it, for the gasket may be used again if

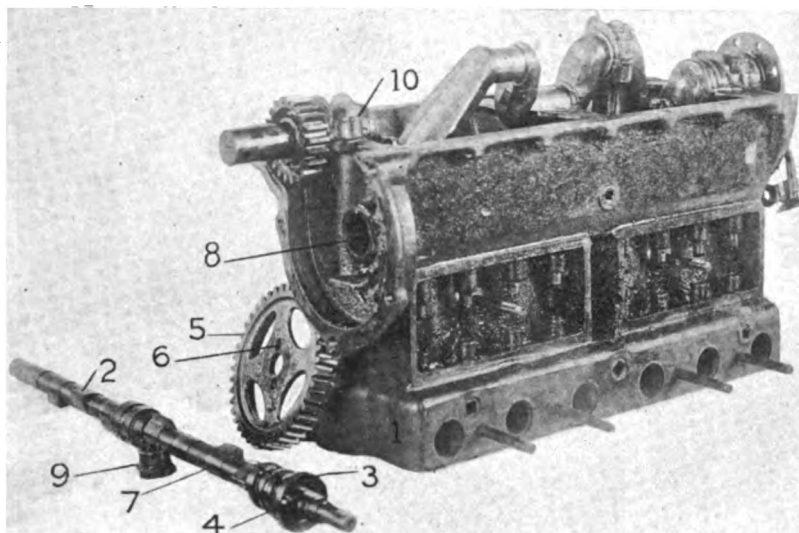
and the rear bushing is bronze that is pressed into the engine block. The forward and centre bearings are secured by cap screws that extend through the engine block from the outside and are seated against them to prevent turning or sliding, and these are secured by lock wiring. Before the camshaft can be removed these cap screws must be taken out, and when this has been done the shaft can be driven out by placing a stiff metal rod against the edges of the cams, or by placing a piece of soft metal on the rear end of the shaft, and tapping with a hammer.

The camshaft can be taken out with the timing gear attached to it, or the timing gear can be removed before the shaft is driven out. The bearings are so large that the cams will clear them, and the only condition necessary is to drive the shaft out. Generally the work can be easier done if the timing gear is first taken off the shaft, for one can work better with the shaft in the block, as it is held securely and the retaining nut may be hard to start.

When the timing gear is to be taken off with the camshaft in the engine block, the crankshaft can be blocked by placing a rod under a crank throw or connecting rod, and then much leverage can be applied to the retaining nut with a large wrench. When the nut has been taken off the timing gear can be loosened, for it is not secured by a drive fit of the dowel, although it is firmly retained. Next the camshaft can be forced from its bearings as described. While the cams are hardened and the end of a metal rod may be butted against them to drive the shaft from the bearings, there is no reason to strike hard blows, and a gentle tapping will be much more effectual and there will be no possibility of damage.

Learning the Bearing Condition.

Before work on the camshaft is begun one had best determine the condition of the bearings, which can be done by "feeling" the lateral movement. The bearings are liberal in size and usually they are well lubricated, so that wear is comparatively slow. The forward and centre bearings are cast iron and these can be driven out of the block when renewal is believed desirable. The rear bearing is bronze and is the smaller, there being probably more wear on this in proportion to the work than on the others. Incidentally, cast iron against steel is a very enduring journal and after "wearing in," when the iron becomes highly polished and the surface appears



Engine Block with Camshaft Withdrawn and Timing Gear Removed.

- | | |
|--------------------------------|-------------------------------------|
| 1—Cylinder Block. | 6—Camshaft Timing Gear Dowel Holes. |
| 2—Camshaft. | 7—Camshaft Cams. |
| 3—Camshaft Timing Gear Flange. | 8—Camshaft Forward Bearing. |
| 4—Camshaft Timing Gear Dowels. | 9—Camshaft Timing Gear Lock Nut. |
| 5—Camshaft Timing Gear. | 10—Front Main Bearing Bolt Nuts. |

not broken. Usually the gaskets are fitted with shellac and are held securely. When the cover has been removed the timing gears are exposed.

How Camshaft Gear Is Retained.

The nut that secures the timing gear on the camshaft is long and has two external diameters, the smaller or forward part being round and fitting into the opening in the cover plate, and the larger or inner part is flattened so as to make a seat for a wrench in tightening or loosening it. This nut is tightly set with a wrench and is not locked. The crankshaft pinion has 21 teeth and the camshaft gear 42 teeth. The camshaft gear is fixed by two dowel pins carried in the flange of the camshaft that fit into holes in the gear.

The camshaft is carried on three bearings, the forward and centre bushings being of cast iron,

to be filled, with good lubrication there should be no appreciable deterioration.

The rear bearing is forced into the engine block under pressure, and the logical manner of removing it is with a drill press. Such a tool, however, is only found in repair shops and service stations that are well equipped. In the event of the bearing being worn it can be taken out by driving it with a soft, copper bar, and the new bearing can be driven into the block in the same manner.

The State of Alignment.

The condition of the timing gears can be determined while the camshaft is in the engine block. There is but little reason to expect that these will wear to any marked degree, for they are constantly flooded with lubricant and as the faces are wide and the gears are large, the surfaces in contact are not subjected to high pressure.

The condition of the camshaft is of considerable importance, for it must be perfectly straight and the cams should have the exact contour that will open and close the valves at the precise points and times that are necessary to maintain engine efficiency. While there is no reason to expect that a camshaft will be sprung or bent, one should understand that there is constant stress upon it, and the alignment of the shaft should be determined when the engine is dismantled. The easiest and most practical manner of testing is to place the shaft between two established centres, as in a lathe, and turn it with a tool or gauge in a fixed position.

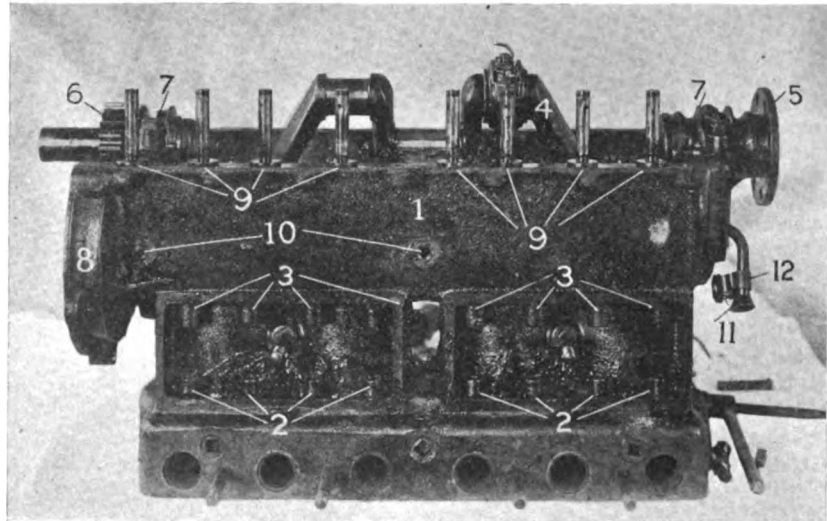
This can be done quickly in a shop where there is a lathe or an aligning machine. Many garages and service stations where repairs are made have a fixture that is intended for testing shafts. With the shaft suspended between the centres a tool or a pencil can be placed at any point and firmly held. As the shaft is turned the degree of clearance, if any, can be determined. If the shaft is sprung it can probably be restored to its original condition by exerting pressure upon it, which must be done by an experienced worker, who can obtain the best results with a press. If there is reason to believe the shaft is not true, either from observation or a rough test, it should be taken to a shop having facilities for accurate testing and restoration.

The wear of the cams can be learned in a general way from noting the condition, but the exact degree cannot be determined save by knowing

the exact sizes of the cams and making micrometer measurements. As a rule the cams are worn very slowly and only in very rare instances and in machines that have been used for considerable periods is replacement necessary for this cause.

Condition of the Tappets.

The cams lift the tappets or push rods that raise the valves, and these tappets are a mushroom type, having wide heads, so that large surfaces contact with the cams, and stems or plungers that operate through guides in the base of the open chambers beneath the valve pockets. The tappets are steel and are hardened and ground to accurate size. The tappet guides are bosses that are tapped and fitted with bushings of iron that are inserted in the tops, the bushings having a forced fit that securely retains them. The tappets are inserted into the guides from the crank chamber and are retained in place by the heads resting upon the camshaft when the shaft is in place.



Engine Block with Camshaft and Valve Tappets Removed.

- 1—Cylinder Block.
- 2—Valve Guides.
- 3—Tappet Guides.
- 4—Crankshaft.
- 5—Flywheel Flange.
- 6—Crankshaft Timing Gear.

- 7—Crankshaft Bearings.
- 8—Timing Gearset Housing.
- 9—Valve Tappets.
- 10—Camshaft Set Screw Holes.
- 11—Oil Tube.
- 12—Oil Tube Clamp.

After the camshaft has been withdrawn from the engine block the tappets can be tested for wear. While there is usually sufficient lubrication there is certain to be more or less wear, and this will be noticeable by side play. The heads do not as a rule wear noticeably. If the tappets are worn more or less noise will result, and restoration is practical by replacement of the bushings and using the same tappets, or in some instances renewal of both guides and tappets will be necessary. Ordinarily the greatest deterioration will be in the guide bushings, the hardened rods enduring much longer. The removal of the tappet bushings is not difficult, and the replacement of new is a work for which no special mechanical experience is needed.

(To Be Continued.)

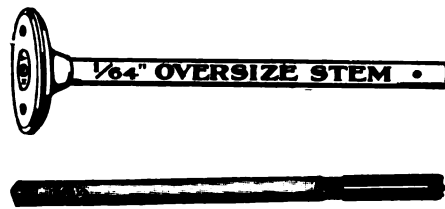
MOTOR CAR ACCESSORIES AND EQUIPMENT.

STEVENS OVERSIZE VALVES.

In a motor which has been used for a considerable time, leaky valve stem guides are frequently the cause of irregular operation and difficult starting. A simple remedy for this trouble is to install Stevens oversize valves, one of which is shown herewith. The heads are electrically welded and the seats ground accurate and true.

The special Stevens reamer, also shown in the illustration, is designed to fit oversize valves. It is made of the best material and carefully ground to give the correct clearance.

Manufactured by Stevens & Co., 375 Broadway, New York City. List price of oversize valves, 20 cents each; standard size of same grade, 15 cents each. Price of special reamer, \$1.50.



EUREKA GRINDING COMPOUND.

The Eureka valve grinding compound is one of the few standard accessories which have proved their worth by test of time and have required no change of quality, price or package to retain the lead among abrasive valve grinding compounds. The one-pound can being of compression type and absolutely air tight, is constantly growing more popular with discriminating manufacturers and engineers.

Eureka compound is put up in three grades: Fine, medium and coarse.

Distributed by J. H. Faw, Inc., 41 Warren street, New York City. Inquiries are solicited by the company.

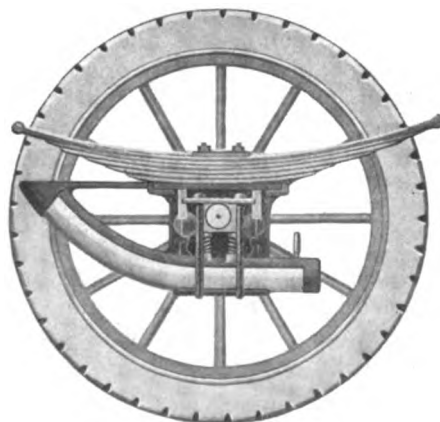
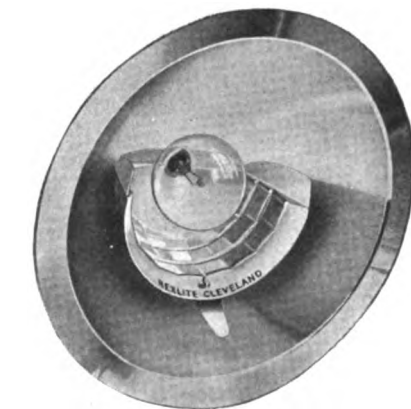


PNEUMATIC TIRE SPRINGS.

The Jones pneumatic tire spring, illustrated herewith, utilizes the pneumatic tire principle as a cushion, but does not contact with the road, thus eliminating all wear from riding friction, blowouts, rim cuts, puncture and numerous other troubles. This device can be attached to any car, without mechanical changes. It is declared that with the use of these springs solid tires may be fitted to the wheels without forfeiting any of the riding quality of the car.

The Jones pneumatic tire spring consists of a shoe and inner tube made in the same manner as a pneumatic tire, but it is installed where wear is slight. Adjustment can be made to any weight by simply inflating or deflating the case as may be required. Pneumatic tires can be used on the car wheels if desired, but the maker recommends solid tires because of the economy obtained.

Manufactured by the Jones Pneumatic Tire Spring Company, 245 West 55th street, New York City. List price, \$150 per set, installed by the company at its service station. A special design of pneumatic tire springs is also made for the Ford car and sells complete at \$50 per set.



THE REXLITE.

The Rexlite, illustrated herewith, is not a dimmer, but instead is a scientific device which gathers the light rays that are usually wasted and utilizes them for intensifying the light ahead of the car. All light rays are diffused and thrown downward and horizontally, thus affording the usual road light as well as curb light. There is no blinding effect to the oncoming traffic.

It is a neat, well made, heavily silver plated attachment designed to fit any electric headlight very readily. A beautiful diamond-like effect is afforded the headlight, thus adding to the appearance of the car. The Rexlite can be installed and adjusted in a few minutes by anyone, as complete instructions are supplied with each pair sold.

Manufactured by the Smith-Standard Company, Cleveland, O. List price, \$3 per pair.

ADVANCE WASHER CUTTER.

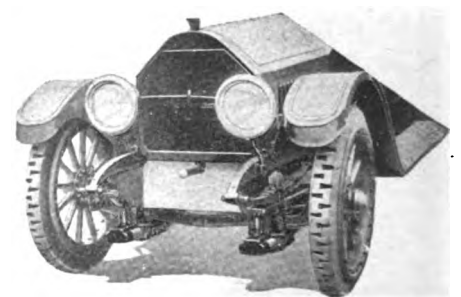
The Advance patent washer cutter, shown in the accompanying illustration, is a hand operated machine for quickly and economically cutting washers of any given size from $\frac{3}{8}$ to $3\frac{1}{4}$ inches outside diameter and any inside diameter. It is designed for cutting small lots of washers from felt or any analogous material such as leather, rubber, asbestos, etc.

The press proper is made of gray iron. The crankshaft and plunger head are of cold roll steel. Dies are made of Shelby steel, tempered and turned down at the cutting end to a sharp, uniform edge. There are 23 dies in the combination, which will cut 529 different sizes of washers. A maple end wood cutting block constitutes part of this outfit.

Manufactured by the Advance Felt Specialty Cutting Company, 161 W. Harrison street, Chicago, Ill. Correspondence solicited.

UNIQU VALVE TOOL.

The illustrated valve tool for Ford engines combines the features of three separate tools. It will ream the valve seat, face the valve and then grind the two to a perfect fit. The cutters are made of the best tool steel obtainable and are carefully hardened and tempered. It is said that they will outlast the car. An ingenious construction allows the reamer to complete a full turn by simply giving



the horizontal handle a quarter turn. This arrangement permits the eighth valve, which is located directly under the dashboard, to be easily seated without disassembling any part of the car. The tool is fully guaranteed.

Manufactured by the C. Spiro Manufacturing Company, 68-72 East 131st street, New York City, N. Y. Retail price, \$1.50.

STORAGE BATTERY CHARGER.

The alternating current storage battery charger, shown in the accompanying illustration, is sold at a price which is within the reach of every motorist and garage owner. It is designed to charge any six-volt storage battery over night without even removing the latter from the car. To operate, the plug is screwed into an electric light socket and the current turned on. The positive and negative wires from the charger are then attached to their corresponding binding posts on the battery and the ammeter will indicate the charging rate of about five amperes. The battery is automatically disconnected should the alternating current supply stop.

Manufactured by the Ohio Electric Works, Cleveland, O. List price, \$15. Complete description on request.

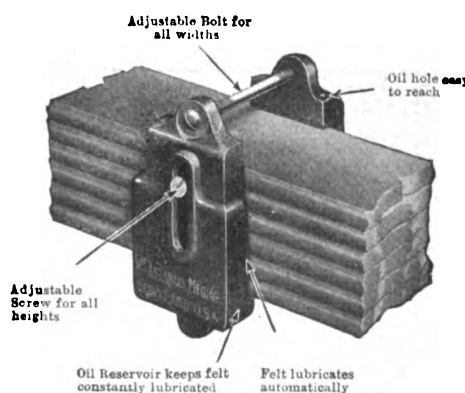
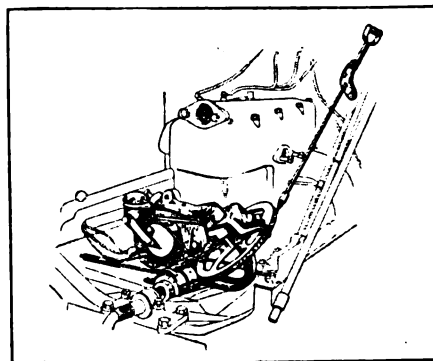
R & M PISTON RING.

The R & M conform piston ring, illustrated herewith, is so designed as to prevent loss of compression and permit the least loss of power from friction. It consists of three parts, a V shaped bull ring and two conform rings of corresponding angles which ride upon the bull ring. This construction combines the advantages of the sealed joint, uniformity of contact with the cylinder walls and compression tightness. It also facilitates starting and checks loss of power, waste of oil, fouling of spark plugs, smoke and excessive carbon deposits. R & M conform piston rings are made in all sizes and for any piston that requires a metallic packing ring.

Manufactured by the Modern Electric and Machine Company, Indianapolis, Ind. Prices range from \$1 to \$1.50.

THE BOSTON STARTER.

The Boston starter is a simple, but substantial mechanism by which the Ford motor can be started from the seat by pulling a handle. The operation is much like the handling on an oar. In case of backfire, the mechanism automatically releases. As a further precaution the spark is automatically retarded to the



proper firing position. The starter is mounted entirely under the hood, the only part visible being the handle. Boring a hole in the dash and a small hole in the frame is all the machine work required to fit it to the car. Its installation adds but 12 pounds in weight to the car.

Manufactured by the Boston Starter and Specialty Company, 188 Columbus avenue, Boston, Mass. List price, \$12.50. Write for complete description.

ADJUSTABLE OILER.

The Lazco adjustable spring lubricator shown herewith will fit all sizes of springs, from those on a Ford car to the largest truck. It is adjustable to both height and width.

Spring manufacturers state that approximately 80 per cent. of spring trouble is caused by lack of lubrication. The Lazco lubricators remedy this condition by permitting oil to be gradually and thoroughly worked in between the spring leaves. Friction is eliminated, rust prevented and the danger of spring breakage minimized.

Manufactured by the Lazarus Manufacturing Company, 746 Euclid avenue, Cleveland, O. List price, 50 cents each; a set of four for Ford cars, \$2; and a set of 10 for other makes, \$5.

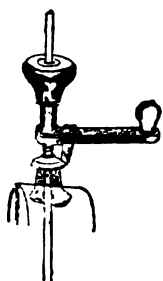
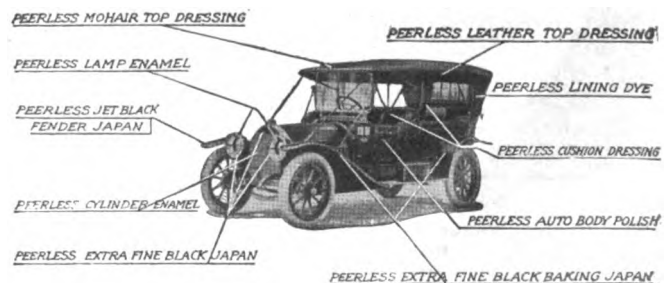
PEERLESS SPECIALTIES.

The line of Peerless automobile specialties for making the old car look like new includes 18 different products for all parts of the machine. Their quality cannot be doubted since they are endorsed by over 6000 automobile painters in this country and Canada. They have acquired a permanent foothold on the market and are backed by extensive circular, magazine, sign and catalogue advertising.

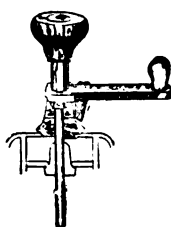
The line includes a mohair top and leather top dressing, lining black dye, cushion dressing, lamp enamel having a gloss finish, lamp enamel giving full finish, black gloss and gray gloss finish cylinder enamel, jet black fender japan, extra fine black japan, Peerless mirroroid for renewing varnish, auto body polish, top dressing for Fords, anti-rust rim paint, liquid wax, acid proof battery box black, tire paint and Peerless shellac.

All products are put up in attractive packages and stack to advantage on a shelf. The maker places a sound reputation of 23 years as a manufacturer behind all Peerless goods.

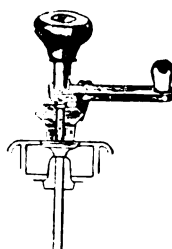
Manufactured by the Columbus Varnish Company, Columbus, O. Descriptive literature and prices supplied on request.



FACING VALVE



REAMING VALVE SEAT



GRINDING VALVE IN SEAT

AUTOMOBILE FIRE PREVENTION.

Practical Suggestions Intended to Check that Carelessness which Is Responsible for Most Fires.

ONE of the first things that a motorist sees when entering a well regulated garage is a sign bearing the legend "No Smoking Allowed." This warning does not necessarily indicate that the garage proprietor is prejudiced against the practise of smoking, if it is done elsewhere, but does show that he is taking a simple precaution to protect his property from destruction.

When one considers that approximately 75 per cent. of all garage fires can be traced to the fact that employees and patrons do smoke while in the garage, then one will understand how necessary it is to refrain from taking any liberties with the frightful agent of destruction which we call gasoline. Gasoline is exceedingly capacious. At one time it can be handled in a manner which at another time would result in explosion and conflagration. Uncertain is a mild word to apply to its "moods," and no sane man or woman will fail to take all due precautions while handling it or while in its neighborhood.

Of course all garage fires are not due to carelessness. As an example of this is the case of the mechanic who while repairing a gasoline line dropped a tool against another piece of steel which caused a spark that ignited the gasoline vapor and resulted in a disastrous blaze. Another instance relates to the repair man who was using an electric bulb to illuminate the interior of a cylinder he was working upon. In removing the bulb it was struck against the cylinder edge and broken and the exposure of the incandescent wire was the cause of a costly fire.

These two instances serve to emphasize the necessity for care in using gasoline. On the other hand, equal care

should be exercised to keep the garage clean. Accumulated refuse which may be composed of oil-soaked rags, wood and other inflammable materials, is frequently the cause of fire. Pools of oil and gasoline drippings on a garage floor are another source of danger, but adequate drainage will overcome this factor. Drains are required by law in public garages, and in private establishments they are equally necessary, though not yet compulsory. A simple, but practical drain can be fashioned out of a barrel filled with crushed stone or sand and sunk in the ground.

As to motor vehicles themselves, fires due to gasoline or oil are not so prevalent as in a garage. Nevertheless, they are possible and consequently the owner or operator should take necessary precautions to prevent them, or at least to stop the flames from spreading. The majority of insurance companies base their rates of automobile fire insurance on whether the insured car owner provides means of protection.

In several states a car owner can have the amount of his fire insurance premium reduced by 15 per cent. simply by carrying adequate fire extinguishers on the car. Considered from that standpoint such equipment is exceedingly economical, especially in view of the comparatively low price at which it is sold. Fire extinguishers need no indorsement—they have been in use for decades and generally speaking have proven their effectiveness in emergencies.

A little forethought and exercise will be the means of preventing automobile fires. When filling the gasoline tank be sure to put out all the gas and oil lights on the car and stop the motor. See that the wires of the lighting and ignition

systems are kept from contacting with the fuel tank or line, otherwise they may become charged with electricity. Similarly, examine the insulation of the wires to see that the insulation has not become worn so that the metal core is exposed. After filling the tank be certain the cap has been replaced and that it is securely fastened.

The subject of fire prevention is one that is becoming of greater importance as the causes and effects of fire are studied more closely. It is a matter of vital importance to everyone, and the evidence brought forward is exceedingly interesting. The Pyrene Manufacturing Company, 57 Vanderbilt avenue, New York City, manufacturer of Pyrene fire extinguishers, has published some very interesting booklets in which fire prevention is discussed in a very entertaining and instructive manner. These books are illustrated with unique fire photographs and are sent to inquirers free of charge.

WARD DISCUSSES CAR SPRINGS.

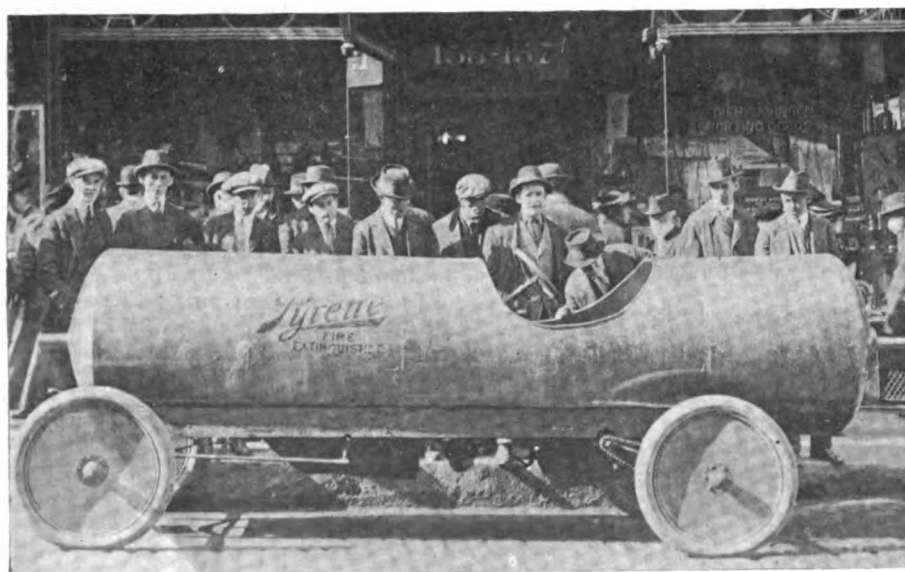
Discussing the various types of springs used in motor cars, Artemus Ward, Jr., president of the King Motor Car Company, declares that it is generally conceded that except for small and light cars the semi-elliptic is the best type to use in front. The reason for this is that the front end of the car should not have what engineers call a "soft ride." The motor should not move up and down too easily. In the rear a "soft ride" can be secured by using a long, semi-elliptic spring.

Three-quarter springs in the rear are hard to adapt to body construction. They are, therefore, being replaced by the semi-elliptic because it is more adaptable and economical. The full elliptic is objected to because it interferes with body and fender design. The body must be higher, which is contrary to the present tendency.

The cantilever is a long spring—48 inches in the King—which, its advocates declare, absorbs shock more efficiently than any other type. There is more steel in it than in the semi-elliptic and in that respect it is more expensive to make, though its simplicity evens up the score to some extent.

WOULD MARK HIRED CARS.

An ordinance is under consideration in New York to require that every motor car let for hire should be marked with a taximeter, or some such device, so that any one can tell at a glance that it is a hired car. This is greatly objected to by about 100 companies which make a practise of renting high-grade limousines and other types to customers who desire that they should look as much like private cars as possible. These are rented for special occasions, or by visitors who spend a month or two in the city or by New York people who prefer hiring to owning a car, because of the responsibility and trouble which might be involved.

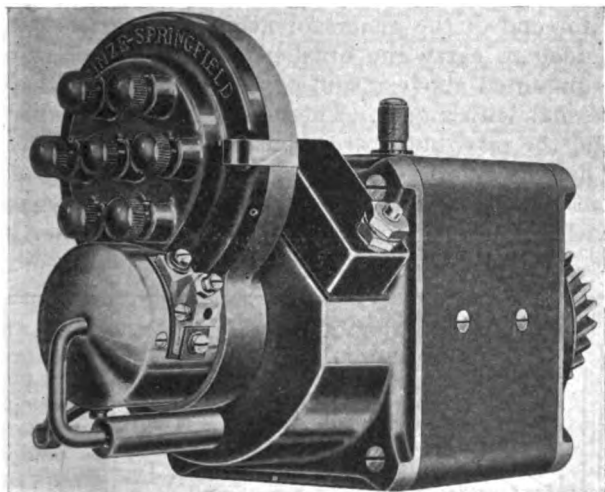


The Pyrene Manufacturing Company's Advertising Car, the "Bullet," which led the Parade in Boston when 4500 Pyrene Fire Extinguishers were taken from a Freight House to the Company's New England Branch just before the beginning of the National Fire Prevention Campaign.

MOTOR STARTING AND CAR LIGHTING.

The Heinze-Springfield Two-Unit System, with which Ignition May Be Incorporated —A Single-Wire Equipment with Novel Control by a Combination Switch.

EITHER single or two-unit Heinze-Springfield systems for engine starting and car lighting are produced by the John O. Heinze



The Heinze-Springfield Generator with Ignition Unit Installed.

Company, Springfield, O., a concern that has within a comparatively short time begun production of this class of motor vehicle equipment. Mr. Heinze has for years been prominently identified with the electrical industry, and after disposing of his interests in other enterprises he organized the company to manufacture starting, lighting and ignition systems to new designs. The company gave over a considerable period to experimental and development work, and the new Heinze systems are maintained to have exceptional qualities in extremely light weight, and because of the very high quality of the materials unusual efficiency and long endurance is assured.

Claims are made that in the design much care was taken to obtain every quality that experience could suggest. Compactness, light weight and simplicity were very desirable, and strength and endurance were imperative. These were dependent very largely upon the quality of metals, and, of course, electrical conductivity and resistance, as well as the character of insulation were extremely important. That there should be no changes after determination and standardization could be adopted to minimize so far as possible manufacturing cost, the designs were carefully developed, and the experimental

machines were carefully and exhaustively tested by laboratory and service tests until they were brought to the efficiency that would justify all the company claimed for them.

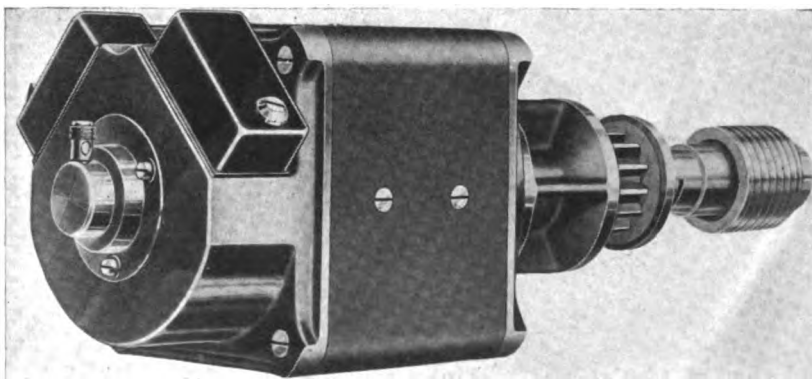
The Two-Unit System.

The two-unit system includes a generator, a starting motor and a switch, with a regulator and a cut-out in the circuit, with a dimming resistance and the usual accessories for the control of the current and the lighting. The system is operated with a single wire connection, the machines and instruments being grounded to the chassis frame, at a pressure of six volts. The battery is a conventional three-cell type. The system is so designed that it may be used either with or without an ignition circuit. The source of ignition current may be any form of magneto driven by the usual means, or it may be the battery in connection with a distributor coupled to and driven from the generator.

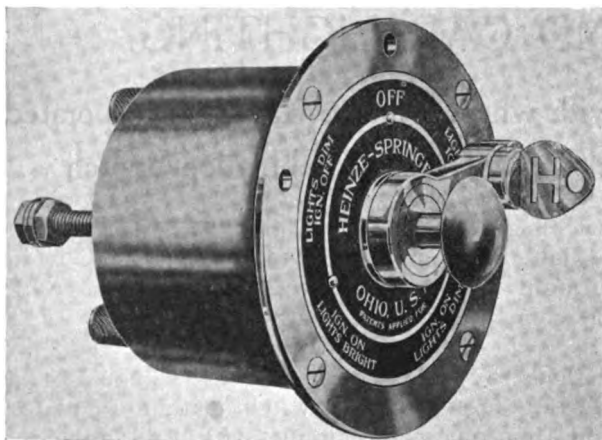
In the construction of the generator and motor all material was selected, not from the price that might be obtained, but because of the desirable metallurgical and electrical characteristics. Careful physical and laboratory tests determine the metals and these are so proportioned and treated that very certain results will obtain. The individual parts are held to very close manufacturing limits in machining and rigid inspection, both before and after heat treatment and after assembling, insures the highest possible degree of standardization.

Four-Pole Generator and Motor.

The generator and motor are both four-pole types. The frames are rectangular steel castings of substantial design that are faced true at the ends, and the front end plates are practically the same, these being recessed castings with solid flanges for the four retaining screws. The recesses of the plates enclose the commutators and



The Heinze-Springfield Starting Motor Equipped with a Bendix Driving Pinion for Flywheel Coupling.



The Combination Heinze-Springfield Switch for Starting the Motor and Controlling Lights.

the plate centres carry the large main bearings. On these plates are removable covers by which the brushes may be reached for examination or work. The rear end plates have large bosses for the main bearings and are similarly retained by four screws. The pole pieces are formed to have ample areas and these are secured by two screws each.

The armature is a slotted drum type with the core formed of soft iron discs, insulated and assembled under heavy pressure with heavy collars securely locked. The channels are longitudinal and are formed with reference to minimizing temperature and to obtaining noiseless operation. The shafts are carefully selected steel that is heat treated. Pole piece and armature windings are of large copper wire that is insulated with cotton fabric. The field coils, after form-

ing, and the armature coils, after assembling, are impregnated with insulating compound and baked to obtain complete insulation. The commutators are high quality copper, insulated with mica sheets. The brushes are a copper carbon compound that are mounted in substantial holders which are designed for easy examination and adjustment.

Motor Construction Similar to Generator.

The motor construction follows closely that of the generator in general detail. The commutator end of the generator armature shaft is extended to carry the breaker and the distributor is mounted above it and driven by a pinion that meshes with a gear. The housing of the breaker and the distributor are secured to the end plate. There is a large spiral gear on the rear end of the armature shaft of the generator that meshes with a gear of the timing gearset of the engine.

The rear end plate of the motor is heavy and

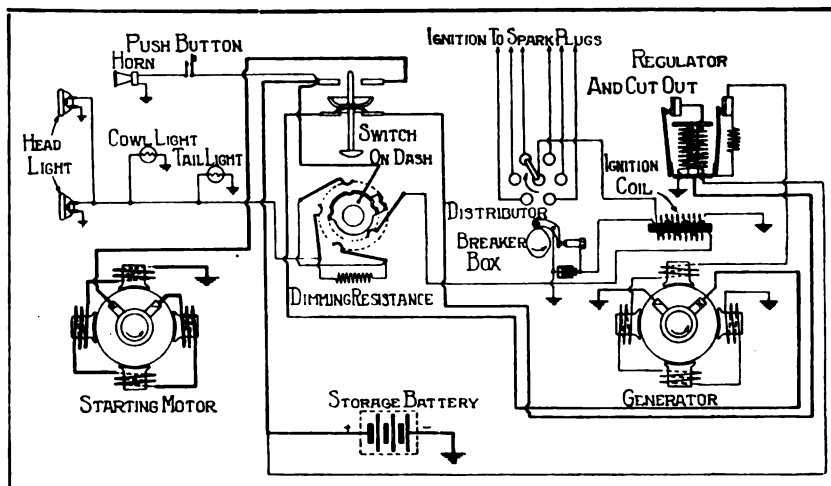
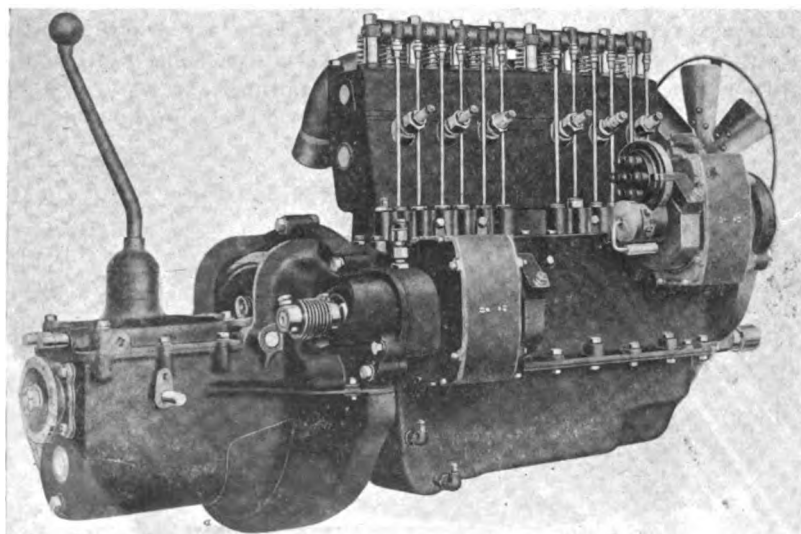


Diagram Showing the Wiring Connections of the Heinze-Springfield Two-Unit System.

carries the large bearing for the armature shaft, which is fitted with an adaptation of the Bendix drive. The motor has been designed to turn the engine at exceptionally high speed.

The generator is regulated by a regulator of the vibrating type that is adjusted to give maximum production at very low engine speed, and it is protected by a cut-out that disconnects the battery when the voltage exceeds that generated by the generator. The system is equipped with a novel combination switch that is a unit in the instrument board. There is one swinging lever by which the driver obtains any combination of lighting and ignition units. The switch can be locked when the vehicle is unattended.

(To Be Continued.)



Heinze-Springfield Two-Unit System Installed on a Six-Cylinder Lycoming Engine.

STUDEBAKER DEALERS GIVE FREE INSPECTION.

ONE of the latest and most beneficial of the plans to give service to car owners is that which has been developed and put into practise by the Studebaker Corporation. Several leading distributors of that make of automobile have adapted the plan and everywhere it is tried both dealer and owner are enthusiastic about it.

Under this system which is known officially as the Studebaker Dealers' Service Plan, the distributor not only is prepared to furnish parts and supplies at reasonable prices, but undertakes to teach the new car owner how to properly operate, maintain and repair his car so as to get the fullest possible service from it.

During the first six months of ownership the car is given seven complete inspections and adjustments at regular and specified periods at the distributor's garage. Each inspection is very thorough, the work men attending to 61 points of the mechanism, which are listed in the illustration of the service report of inspection herewith. In addition to this a tester takes the car out on the road to examine it for maladjustment or mechanical troubles. He reports his findings to the garage foreman and the troubles are attended to before the machine is turned over to the owner.

The schedule of procedure is as follows: When one buys a Studebaker car at any one of the agencies where the plan is in force, he is given an inspection date card, copy of which is shown in the illustration, with the dates on which the car is to be brought into the garage properly recorded in the spaces provided for them. The first date is set for 15 days after purchase, and the second 15 days later. The five succeeding inspections are scheduled for not less than once every month until the six months' free service period is ended.

About three days before each inspection the car owner receives a postcard from the dealer, which serves as a reminder that the company expects the car to be brought in on the date set. A few days after the inspection another postcard is received, it containing inquiry as to whether the car is operating satisfactorily. This procedure is followed out until the end of the free inspection period.

It is essential that these appointments be kept religiously so as to avoid congestion of work in the dealer's garage. As an instance, the

Donovan Motor Car Company, the Studebaker distributing and service station in Boston, Mass., which is one of the largest and latest to adopt the plan, has capacity for 10 inspections every day, and its dates are arranged accordingly. If these appointments were not made and kept the service would soon be in a chaotic condition and owners would not receive their share of the benefits.

If for any reason the appointment cannot be kept, the owner is requested to notify the dealer, who will endeavor to work in an inspection on some day for which 10 inspections have not been scheduled. In case the owner finds after one of these investigations that the car is not operating satisfactorily, he is urged to bring it in immediately and not to wait for the next scheduled date.

By this system the car is given regular and thorough care by experts who have been trained in this particular work, and the owner receives a liberal education in the operation and care of every component and system of the mechanism. The work men also examine the finish of cars and notify the owners if it is not being attended to properly. Furthermore, they test the inflation of the tires and advise if the pressure is incorrect. If the owner is using an oil not suited to the mechanism he is told which kind to use, and if he does not keep the engine clean he is told of danger of neglecting this important unit. Owners are not inconvenienced appreciably by having their cars laid up for inspection for the periods are comparatively short in view of benefits derived.

A series of record forms provide full protection for both dealer and owner, as is shown in by the cards illustrated on this page, and furnish a complete "history" of the car for the six months of free inspection. This is exceedingly valuable data, as the owner will find at the end of the season if he desires to trade in that model for a newer one. The record is also valuable in that it teaches the operator what points to examine periodical and how often.

Wherever the Studebaker Dealers' Service Plan has been put into operation it has been found that car owners show a rapid increase in the ability to handle their cars so as to obtain the maximum of service from them, and also that at the end of the season the value of a car has not depreciated as rapidly as it would have otherwise.

SERVICE REPORT OF INSPECTION CARD NO. _____

NAME _____ ADDRESS _____ TELEPHONE NO. _____

MODEL _____ CAR SERIAL NO. _____ MOTOR NO. _____

INSTRUCTIONS—Made to be returned by Foreman of Service Dept. from inspection of car. Where adjustments should be made check (✓) space and checked to prevent inspections being scheduled. Inspected on date of next inspection, retained in Service Dept., and filed permanently. File of the dealer whether owner has given them care.

FRONT END	Year	Year	Year	Year	Year	Year	Year
1 Grease wheel bearings							
2 Grease steering knuckle							
3 Tighten steering knuckle or bend if							
4 Turn up play in steering knuckle rod							
5 Oil steering knuckle							
6 Grease both ends of front springs							
7 See that steering gear is working O. K.							
8 Grease steering gear							
9 See that steering gear bracket is tight to frame							
10 Oil control valve, shift and throttle levers							
11 Lubricate oil of light							
12 Inspect for center plate throughout							
13 Grease spring leaves on two days' inspection							
MOTOR							
14 Remove carbon if necessary							
15 Test compression with valve							
16 If weak adjust push rod to proper clearance							
17 If weak wash down of valve valve							
18 Touch up valves if needed							
19 Examine spark plugs and clean if necessary							
20 Tighten oil leads							
21 See that oil pump is working properly							
22 Clean oil sight glass and patch							
23 See that oil gauge registers properly							
24 Inspect water pump							
25 Oil water pump							
26 See that fan belt is tight							
27 Test generator charging rate							
28 See that brushes are not worn							
29 Inspect and clean distributor							
30 See that battery plates are covered							
31 Report any dead cells							
32 Adjust carburetor if necessary by meter							
33 Inspect water and gasoline connections							
34 See that ignition wires are O. K.							
35 Lubricate clutch cable							
36 See that grease tube is O. K.							
37 See that dust pan is fastened properly							
38 Inspect clutch and oil facing if necessary							
39 Oil generator							
40 Oil starter							
41 Oil fan							
42 Inspect brake shoe contact points							
REAR END							
43 Adjust brakes and see that they squeak							
44 Oil brake cam and clevis							
45 Examine torque arm, radius rods and brake rods							
46 Examine torque arm springs							
47 Examine hand control							
48 See if gears are properly spaced							
49 Grease all rear spring shackles							
50 See that oil and grease are in transmission							
51 Tighten body and fender bolts							
52 See that lights work properly							
53 Examine lighting correct for lamp connections							
54 Grease spring leaves on two days' inspection							
55 See that axle is properly greased							
56 Examine rear wheel bearings and grease if necessary							
57 Remove all squeaks and rattles, if any							
GENERAL							
58 See if tires are properly inflated. If not, notify owner							
59 See that body finish gets proper care. If not, notify owner							
60 Notify owner if he is using poor oil							
61 See if motor is kept clean. If not, notify owner							
REMARKS							
1st Inspection							
2nd							
3rd							
4th							
5th							
6th							
7th							
Foreman's Signature							
Tester's							

Inspection Dates
Card No. _____

This card entitles _____

subject to conditions mentioned on the opposite side, to free inspection of his _____

Motor No. _____

Serial No. _____

License No. _____

purchased on the following dates: _____

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

Notice: Retain this card and present at service department when call for inspection

Studebaker INSPECTION TAG

Instructions: Made to be returned by Foreman of Service Dept. from D2002 and attached to Motor. Follow up portion of tag to Service Dept. for reading D2002 in car owner's file.

CARD NO. _____

NAME _____ MOTOR NO. _____

MODEL _____ A.S. DATE _____

TIME _____

PROVIDED BY _____

AUTHORIZED BY _____

Follow-Up Ticket

NAME _____ MOTOR NO. _____

TIME _____

PROVIDED BY _____

TIME UNL. ENDED _____

FOLLOWED BY _____

REMARKS _____

Three Forms Used in the Studebaker Dealers Service Plan.

INDUSTRIAL NOTES AND COMMENT.

Recent Happenings Among the Makers of Cars and Equipment and Members of Related Industries.

The Simons Sales Company, Overland dealer at Saginaw, Mich., is said to have one of the largest areas of window spaces ever used by an automobile dealer. The first floor show room is 108 feet by 40 feet, as is the second floor show room. Plate glass windows extend the full length and width of these rooms, and this gives the Simons company opportunity to display 17 cars simultaneously. On the first floor is a garage 108 by 80 feet and on the second floor a repair department of the same size. During the current season this company has placed orders for 2000 Overland and Willys-Knight cars.

Paige Has Rifle Corps.

The Paige-Detroit Motor Car Company, Detroit, has undertaken the organization of a rifle corps among its employees. A short time ago this company opened a citizenship bureau so that every worker not a naturalized citizen could have opportunity of becoming such with the aid of the company. The rifle corps is now being organized and is expected to start with a membership of more than 100 men.

Pathfinder Output Increasing.

The extraordinary demand for high-grade automobiles this year is reflected in the production schedules of the Pathfinder Company, Indianapolis. Since the first of the year the number of cars shipped shows an increase of 400 per cent for January, 226 per cent. for February and 226 per cent. for March as compared with the corresponding months of 1915. Sales are now running 100 per cent. ahead of production and output is now at the rate of 200 per cent. more than during the same period of last year.

Dort Motor in New Role.

When the spring thaws and unusually heavy rains raised the Flint river at

Flint, Mich., the Dort Motor Car Company's plant, which is situated on the river bank, was flooded, and the work men had to cease operations. J. D. Mansfield, sales manager, conceived the idea of pumping out the water by using the motors of two Dort chassis. These were attached to a large four-inch centrifugal pump borrowed from the local fire department and in a very few hours the employees were able to return to their work. Though the river continued at its high mark for several days, the motors and the fire pump had no trouble in keeping the Dort shops and offices free of water.

National Coil Works Nights.

To meet the requirements imposed by increased demand for its product, the National Coil Company, Lansing, Mich., has been compelled to add a night force to its working staff, and because of the success of the company's small high-tension magneto it is expected that new additions will soon be under way, although definite announcement to that effect has not yet been made. The company is receiving new machinery, which is being installed as rapidly as possible and additional men are being added to operate it.

N. C. R. Company Offers Prizes.

The National Cash Register Company is offering \$50 for the best suggestion submitted by an employee of retail stores relative to the improvement, sale or use of National cash registers. Altogether 99 prizes aggregating \$1000, will be awarded, and in this order: \$40 for the second best suggestion, \$30 each for the two next best, \$25 each for the next five, \$20 each for the next 10, \$10 each for the next 25 and \$5 each for the next 55. The contest closes at midnight July 15, 1916. It is open to employees of retail stores everywhere. Suggestions should be sent to the company's office at Dayton, O.

Hupp Breaks Records.

The Hupp Motor Car Corporation reports through Lee Anderson, commercial manager, that sales and production of Hupmobiles during March broke the February record and set a mark larger than any established during the company's existence. The increase over the corresponding month of 1915 was 69 per cent. The first quarter of 1916 shows a gain of 70 per cent. and is the best three months the company has ever experienced.

\$800,000 for Freight Charges.

Some idea of the volume and value of freight received at the Willys-Overland company's plant at Toledo is indicated by the fact that during 1915 this company paid out over \$800,000 for freight charges on inbound freight alone. The Overland company has 7½ miles of railroad tracks on its property and more than three miles of storage tracks built outside of the plant proper.

Studebaker Stops Waste.

To determine what is economical gasoline consumption for its cars, the Studebaker Corporation has been making tests throughout the country. Averages of from 16 to 18 miles per gallon have been obtained with the four-cylinder cars and 15 miles per gallon with six-cylinder cars.

Experts are sent to visit owners who are not getting the gasoline mileage they should. The investigator disconnects the regular tank and connects a small auxiliary tank. Then the owner drives the car a certain number of miles and the quantity of gasoline used is measured.

The expert then adjusts the carburetor and anything else on the car that needs attention and taking the wheel shows the owner the weaknesses in his method of driving, which if corrected would result in a higher gasoline mileage.

Eisemann Station Taken Over.

The Eisemann Magneto Company has discontinued its New York office, which has been taken over by the Auto Electric Service Company. With the same stock and machines the business will be continued at 245 West 55th street and will



The New Establishment of the Simons Sales Company, Saginaw, Mich., Overland Dealer, Which Is Said to Contain the Largest Area of Window Space Ever Used by an Automobile Dealer.

continue to act as the Eisemann service station for owners in New York City, Long Island City, the Bronx, Westchester and Rockland counties in New York, and Bergen, Hudson, Essex and Union counties in New Jersey. The company is owned by Henry Berlinghof, who for three years has been service manager of the Eisemann company, and George Strasser, for the past 10 years foreman of the Eisemann repair department. William D. Clowes succeeds Mr. Berlinghof as service manager of the Eisemann Magneto Company.

Chalmers Business Large.

Following announcement of an increase of \$40 in the price of Chalmers Six-30 touring cars, the company officials have compiled figures showing that in the 27 working days of March the Chalmers company shipped cars to the value of \$3,865,000. On March 31 cars valued at close to \$300,000 were dispatched. The plant is running on a day and night schedule and unfilled orders on the books the first of April amounted to \$8,400,000.

The increase in Chalmers prices went into effect April 15. The touring car price was raised from \$1050 to \$1090, the cabriolet from \$1400 to \$1440, and the roadster from \$1050 to \$1070. Although the Six-40 was raised in price on March 1, the following month showed the greatest increase in the sales of that model since it was brought out.

Hupp's Ignition System.

The Atwater Kent Manufacturing Works announce that the Hupp Motor Corporation has renewed its contract for Atwater Kent ignition and that it will be standard on the 1917 Hupmobile.

GETTING MORE MILEAGE.

Before replacing an old carburetor by a new gasoline saving design, Horace T. Thomas, chief engineer of the Reo Motor Car Company, urges that the owner clean up his engine and see what the old one will do when freed of dirt. The carbon should be removed from the cylinders and kerosene should be run through to loosen up the piston rings. The valves should be ground and the owner should adjust the motor bearings and see that the clutch is working properly.

Nearly any carburetor will work better if it is given a chance with a clean, well adjusted engine. Such a course of treatment for an old car is sure to have good effect in cutting the cost of the gasoline used.

THREE-PASSENGER ROADSTERS.

Officials of the Olds motor works believe that the production of three-passenger Oldsmobile roadsters forms a larger percentage of the total Olds output than is the case with any other manufacturer who makes a similar model. Of all the Oldsmobile cars made 18 per cent. are three-seated roadsters. This is accounted for by the fact that the car is amply roomy for three passengers and can even be used with comfort by four, because the rear compartment can be converted into a leather upholstered seat for two people.

PRIZES FOR ROAD PHOTOGRAPHS.

National Highway Association Announces Contest In Which \$2600 Will Be Awarded in 166 Prizes.

For such photographs of good and bad roads as can be used to aid the good roads movement, General Coleman du Pont and Charles Henry Davis are offering \$2600, divided into 166 prizes. The judges of the photographs will be Theodore Roosevelt, Mark Sullivan and Ida Tarbell.

The first prize will be \$500; there will be five prizes of \$100 each, 20 prizes of \$25, 40 prizes of \$15, 100 prizes of \$5.

The photographs will be judged on their merit, first, as showing road conditions either good or bad; second, pictorial interest; third, photographic excellence. Anyone may become a competitor without reference to whether he is a member of the National Highways Association, which is conducting the contest, or not. It is hoped that the contest will arouse much interest in the work of the association, however, and lead many contestants to join.

Any number of photographs may be submitted, but all must be of roads within the United States. Prize winning photographs will become the property of the National Highways Association, which shall have the right to copyright, and the full name and address of the contestant must be on all the prints. No photographs will be returned, but none will be published unless they win prizes or are purchased. They should be sent to the Good Roads Everywhere Photograph Contest, National Highways Association, Washington, D. C. The contest will close at noon, Tuesday, Nov. 7, 1916.

INQUIRIES ABOUT MILEAGE.

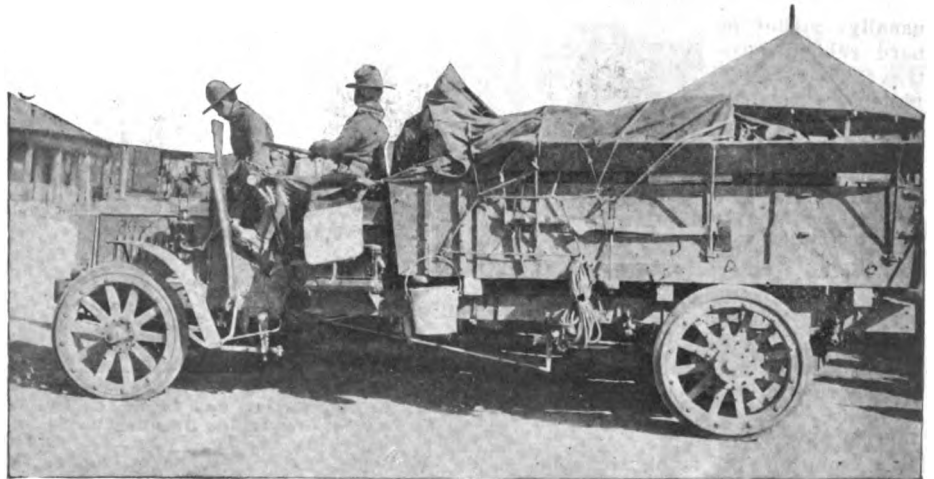
Since it was announced that F. E. Slason of Plainville, Kas., winner of the Hyatt Roller Bearing mileage contest, had driven his Buick 261,800 miles, he has received hundreds of letters inquiring how the mileage had been attained.

One of these came from Richard Abbott, a war refugee at Villa La Picpouliere, Yport, France. He said: "I am afraid I shall not be able to sleep much until I hear from you yourself, giving me an idea of how you have been able to make such a mileage. I take it that Kansas has a rigorous winter climate, with a fair amount of snow, lasting pretty well through the three months. Taking that into consideration your wonderful record is still more so."

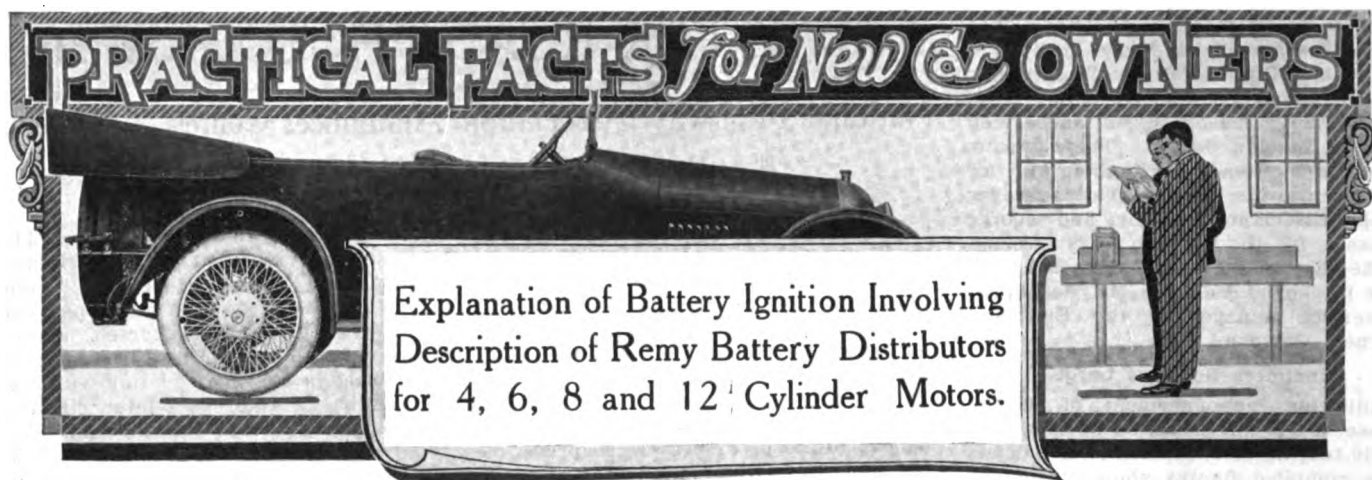
"Now 100 miles a day for a few months during good weather and on our hard, straight, smooth French roads, is away above the average made by the most fervent drivers over here; in this country rain does not affect the roads, they are built on solid foundations that hold up the surfaces and drain off the water; they are stone and do not make mud. They are free from snow in the winter and almost as fast in January as in July. Even with French roads and the mild French winter I do not see how you could have covered so much ground."

Mr. Slason replied to the letter as follows:

"Will say that Kansas is a dry state, having mild winters and scarcely any snow. We run our cars 365 days and 365 nights in each year on the best natural dirt roads in the world. Last fall I drove from Colorado Springs, Col., to Plainville, Kan., a distance of 347 miles—in 11 hours and two minutes; so you see the roads are not bad in this part of the United States. This car not only does livery service, but goes out on trouble service, pulling in cars and taking supplies out to cars and also hauls travelling men's trunks. We only had to drive two hours in each 12 since we have owned the car to make 261,800 miles. This is not excessive when you remember that five or six of my drivers use the car in one day. Often one goes out as soon as another comes in."



A Unit of the "Flying Squadron" of the Mexican Expedition—A Packard Truck at Columbus, N. M., Loaded, Fully Equipped and Ready to Leave for the Interior—These Vehicles Average About 110 Miles in 15 Hours Over a Roadless Desert Land.



SEVERAL readers whose cars are provided with battery ignition have asked to have the principle of operation of that system explained in these columns. Consequently, this installment will be concerned with the fundamentals of that type.

Battery ignition was used by the majority of car makers in the early days of the automobile industry, but since then the magneto has been developed to a dependability that has been responsible for its adoption by a great many of the leading manufacturers. However with the increasing improvement of the electrical generator the battery system is returning to favor.

The earlier types of battery ignition relied upon dry cells for the source of current, but due to the comparatively short life of the cell and the fact that the charge made for recharging it is high compared to the cost of the cell, this system was found inadequate for continuous ignition. The dry cell is much used for intermittent work, however, and gives very satisfactory service.

Storage battery is a term applied to the type of chemical generator which is to be found in almost every up-to-date car. The name is often misleading to the average motorist, and it would appear that the battery has not been given the proper name, since such an appliance does not store electricity in the sense of being a reservoir, but instead produces a current by a certain chemical change in the nature of the elements of which it is composed.

How Storage Battery Differs from Dry Cell.

The storage battery differs from the dry cell because when exhausted it is capable of regeneration by passing a current through it in an opposite direction to that of the flow of discharge.

There are many couples or combinations of substances which theoretically will fulfill the condition of regeneration after exhaustion, by passing a current through them, but none have proved commercially available save lead plate combinations. The commercial storage cell consists of a jar retainer usually made of hard rubber, positive and negative plates, separators between the plates and the electrolyte. The positive and negative plates can be easily distinguished by their colors, the former having a velvety brown or chocolate color and the latter a light gray, after formation is complete.

The electrolyte is a solution of sulphuric acid and distilled water. After the plates have been properly set in the retainer the electrolyte is poured in. The current is then passed through the plates and solution. This is the manner in which a storage battery is originally charged, at which time the spe-

cific gravity of the electrolyte when tested with a hydrometer should range between 1.270 and 1.290. When the gravity registers between 1.150 and 1.170 the battery is practically discharged, and should be recharged. Space does not permit a detail description of the storage battery and for the present we will dismiss the subject and take it up again later.

Batteries, regardless of their type, produce a current of low potential which cannot be used for ignition purposes until built up. Like the current obtained from a low-tension magneto, the current is increased or stepped up by being passed through the windings of a transformer coil. The principle of this member has already been described.

Purpose and Operation of the Timer.

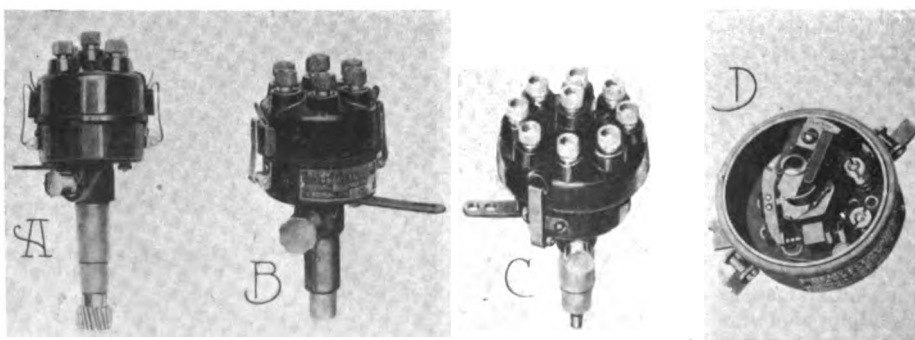
In the preceding chapters it was explained why it was necessary to make and break the current at certain intervals so that it could be directed to the proper cylinder at the correct time. The same principle is true of battery ignition. It is necessary to place some contrivance in the circuit which will complete and break the circuit at the proper times. This mechanically operated switch is termed the timer. It is always placed in the primary circuit and its purpose is to complete that circuit so that a current of high potential will be induced in the secondary windings of the coil and thus cause a high-tension current to flow to the spark plugs when required.

The timer is one of the most important factors of the ignition system. It is the distributing device which insures that the current will be made to flow through the circuit at the proper time for ignition of the gas in the cylinders. The timer, or engine operated switch, is designed to make hundreds of positive contacts within a period of a minute. In other words, it is a contrivance for opening and closing the primary circuit and is either called a timer or commutator. When it is used for interrupting the high-tension current, it is termed a secondary distributor. There is no distinction between the two forms and therefore there is no arbitrary ruling as to whether a certain construction is a timer or a distributor.

Let us first consider the timer or primary circuit breaker, of which there are numerous types. In its simplest form it may consist merely of a brush or spring so arranged that at a predetermined time, contact is made by a suitable cam with this spring, completing a circuit which at all other

times was open. This type is unsatisfactory for high speeds.

When the motor has a multiple of cylinders it is necessary to use an arrangement whereby the rotating brush or cam makes a number of contacts at each revolution. The position and number of contact points on the circumference



Remy Distributors for Four (A), Six (B) and Eight (C) Cylinder Motors—D, Interior View of the Remy Breaker Box.

Have You This Plug on your car ?



CLASS OF SERVICE	SYMBOL
Day Message	Blue
Day Letter	Blue
Night Message	N L
Night Letter	N L

If none of these three symbols appears after the check (number of words) this is a day message. Otherwise the character is indicated by the symbol appearing after the check.

RECEIVED AT

WESTERN UNION TELEGRAM

NEWCOMB CARLTON PRESIDENT
BELVIDERE BROOKS VICE PRESIDENT

GEORGE W. E. ATKINS
630CHN 29 BLUE 4 EXTRA
DAYTONA FLO 1045 & APRIL 10 16

CHAMPION IGNITION CO
FLINT MICH

HUDSON SUPER SIX STOCK CHASSIS USING A C STANDARD PLUGS MADE A
HUNDRED AND TWO AND FIVE-TENTHS MILES AN HOUR ON DAYTONA-BEACH
ELECTRICALLY TIMED.

HUDSON MOTOR CAR CO
PER E V RIPPINGILLIE
248P

NOTE—Every Spark Plug had to be on its job to make this speed

59

Leading Car Builders Equip with AC

Packard	Oldsmobile	Davis	Case Tractors	McLaughlin
Pierce-Arrow	Dodge	Detroit	Chase Truck	(Canada)
Cadillac	Brothers	Peterson	Daniels	Mercer
Marmon	Reo	Moon	Empire	Monroe
Hudson	Paige	McFarlan	Federal	Pilot
Chalmers	Peerless	Westcott	G. M. C.	Sayers
Hupmobile	Stearns	Enger	Gramm	Seovill
Chandler	Knight	Gilde	Trucks	Crane
Haynes	Saxon	Lexington	Jeffery	Simplex
Chevrolet	Stutz	Howard	Kissel Kar	Singer
Dort	National	Austin	Knox	Stephens
Cole	Vellie	Brockway	Lambert	United Truck
Buick	Jackson	Truck	Maxwell	Wilcox Trux
Oakland	Apperson			

Champion Ignition Co., Flint, Michigan

For the Best Results and Smooth Running at All Speeds AC Spark Plugs

Sold Everywhere

(When Writing to Advertisers, Please Mention The Automobile Journal.)

DEALERS and OWNERS

Here is a simple, practical device which solves your greatest problem, the carburetion of the present low grade gasolene.



*Make Exhaust Help
Run Motor*

The arrow points to the story, gas vaporized where it is needed, right at the valve openings.

A Post Card Will Bring Full Information

WILMO COMPANY

208 S. LA SALLE STREET

CHICAGO

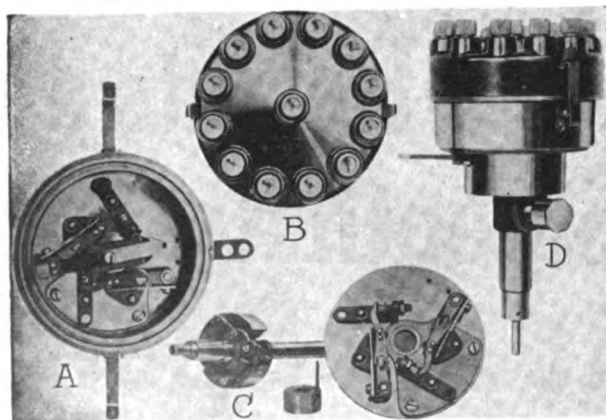
of the timer depends upon the number of cylinders contained in the motor. When an engine is composed of a single cylinder the contact point may be placed anywhere around the circumference and the brush secured so that it will contact with the point at the proper time. When two cylinders are used the points must be spaced 180 degrees apart, or diametrically opposite each other while with a four-cylinder engine the points must be placed 90 degrees apart, the Ford timer being an example of this construction. It may be well to state that the contact points are always made of metal

sluggishness of action in the vibrator of the coil which precludes the obtaining of that absolute synchronism of ignition necessary to obtain perfect results. This is caused by what is commonly known as the magnetic lag, it being the time required to magnetize the core so that it will attract the vibrator hammer. Perfect synchronism may be obtained by several methods, either by using a master vibrator or the use of a single unit coil and a mechanism for breaking and distributing the current to the cylinders.

The Remy Electric Company, Anderson, Ind., and Detroit, Mich., has a line of battery ignition distributors of the latter type. The construction incorporates a primary timer and a secondary distributor. Both are attached to each other and the contacts are arranged so that contact is made at the same time, thus insuring absolute accuracy in distribution.

In these instruments the distributor proper, which is located at the top, is of the most simple and reliable design. The high-tension current is distributed by a segment, which revolves close to the pins, or contact points, in the distributor head. The exposed springs which hold this head in position are designed to be quickly disengaged for the purpose of removing the head for inspection of the working parts. In the breaker mechanism the circuit is normally closed and the contact points separated by a specially ground steel cam. Inasmuch as the spark occurs when the contact points are separated, absolute synchronism is obtained throughout the entire range of speed.

The Remy distributor for 12-cylinder motors is of particular interest in that it is a departure from former construction, it incorporating two contact breakers, both of which are operated by one accurately finished six-pointed cam. One breaker is mounted on a steel plate that is concentric with the central line of the distributor and has a boss in which is a hole, through which the distributor shaft passes. The second breaker is carried on a smaller plate that is secured to the larger plate by a series of screws. The smaller plate is collared around the boss, so that all parts move in concentric circles around the central line of the distributor.



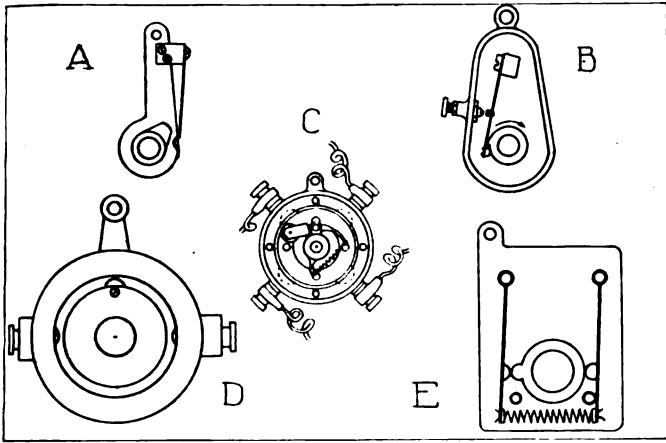
Remy 12-Cylinder Distributor: A, Interior of the Breaker Box Cap Showing the Two Breaker Arms; B, Exterior of the Distributor Cap, Which Carries 12 Terminals; C, Distributor Shaft, Cam and Plate Carrying the Two Breaker Arms; D, the Assembled Instrument.

and set in a case of non-conducting material, fibre generally being used.

Methods of Obtaining Synchronism.

The use of this form of timer necessitates a separate coil for each cylinder to be fired. While the time of a spark may be relatively the same in each cylinder, there is a certain

(When Writing to Advertisers, Please Mention The Automobile Journal.)



Types of Timing Devices—A. Single Wipe Contact; B. Single-Cylinder Form, Platinum Points Complete Circuit; C. Rolling Contact Form for Four Cylinders; D. Connection Made by Balls and Roller. E. Two-Cylinder Wipe Contact.

Obviously, to obtain accurate timing there must be an extremely accurate relationship between the breakers and the six-pointed cam mounted on the distributor shaft, so that the breaker arms will be lifted alternately. To obtain this close adjustment the distributor is mounted upon a synchroscope after assembly, and each plate carrying a breaker is moved until each breaker is in the proper position to obtain perfect synchronism. When the positions of the arms are found the plates are secured with screws.

Stiff, double-leaf, flat springs are used to produce pressure against the fibre blocks that are riveted to the centre of each arm of the contact breakers. This design, together with the light breaker arms, affords fast, yet smooth breaker action.

The construction of the unit is such that the distributor can be disassembled without the use of special tools. Another feature is that either manual or automatic spark advance, or both, is practical with this instrument. Ample protection is insured the insulation of the system by a safety gap incorporated in the Bakelite distributor segment arm.

But one coil is used with this system. Each winding is passed around a soft iron core and each layer is heavily insulated to insure against voltage strains. The windings then are saturated with a special compound that will, the maker declares, resist any temperature to which they may be exposed. They are further protected by a number of pieces of Bakelite, and when completed the coil is enclosed in a lacquered fibre tube to which Bakelite end pieces are fitted.

SHARPENING DULL FILES.

A file that has become useless through the space between its teeth being choked with metal and oil can be made serviceable again by washing. First wash them thoroughly with warm water and then place in a wooden vessel in which is a solution of about a quart of warm water, three ounces of borax and an equal amount of finely powdered blue vitriol. Turn the files in the mixture for a short time and then add half an ounce of vinegar and 10 ounces of sulphuric acid. Allow them to remain in this for about 10 minutes, after which dry with a cloth, rub with olive oil and then wrap in porous paper.

This process will thoroughly clean the tools and in most cases will even sharpen the teeth of worn ones. Fine files should not be allowed to remain in the bath as long as coarse ones.

STORMY WEATHER SUGGESTION.

Spring rain storms are generally accompanied by strong winds. Nothing will effect an electrical apparatus quicker than moisture. When it is necessary that the car should be parked in a rain storm for several hours, always leave it with the radiator facing against the wind. When in this position the rain will be blown past the fine tubes into the carburetor, magneto, generator, etc.

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WHEN the question of ignition looms up big, as it should when selecting your car, you will do well to give consideration to the record made by

BOSCH

MAGNETO IGNITION

Bosch Magneto Co., 204 West 46th St., New York

METZ Touring Car or Roadster \$600 F. O. B. Waltham

Both Touring Car and Roadster built on same chassis, 108-inch wheelbase, and carry identical equipment, including electric starter and electric lights, 25 h. p. water-cooled motor, large wheels and tires, rain vision windshield, instant one-man top, speedometer, built-in gasoline gauge, signal horn, etc. Write for DEALER particulars, and new catalogue "Q."

METZ COMPANY, WALTHAM, MASS.

VALVOLINE OIL CO.

Heavy, Medium and Light

Automobile Oils

27 STATE STREET BOSTON, MASS.

Peerless Quality in Smaller Size

"ALL PURPOSE" FOUR AND SIX

FOUR AT \$2,000

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THE PEERLESS MOTOR CAR CO., CLEVELAND, OHIO

Makers also of the "48-Six" and Peerless Trucks.
Licensed under The Kardo Patents.

LITTLE WONDER VAPORIZING VALVE

Guarantees a saving from 25 to 44% in gasoline bills.
Equal mileage, greater motor efficiency at a saving from 25 to 44%.
A permanent, real economy.

Price complete \$5.00.

Will last for years.
Write for proof.

Sold by all dealers or direct.

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MASTER

CALORITE SPARK PLUGS

The highest achievement in spark plug construction—
All standard threads carried in stock—
Master Calorite Spark Plugs are backed by this
broad guarantee—

"We guarantee Master Calorite Spark Plugs against
defects of material or workmanship and will replace
free of charge any Calorite insulators broken by heat
which are returned to us transportation prepaid".

Try Master Calorite Spark Plugs—Send
for illustrated literature and trade propo-
sition.

HARTFORD MACHINE SCREW CO.
515 Capitol Ave. Hartford, Conn.



COMPARISON OF GEAR SIZES.

(G. R. C., Emmetsburg, Ia.)

Will you please give me a comparison of the sizes of drive
shaft, rear axle and differential gears of the Ford and the
Chevrolet 4-90?

In the Ford car the driving pinion has 11 teeth, the differ-
ential ring gear 40, the differential gear at the end of the axle
shaft 24 and the differential pinion 12 teeth.

The gears used in the Chevrolet car have exactly the same
number of teeth as those used in the Ford car. However, re-
pairmen advise that the gears of one car are not interchange-
able with those of the other.

CONTACT POINTS.

(W. H. M., Mt. Healthy, O.)

Will you please answer in the Readers' Queries column of
the Automobile Journal:

How far apart should the platinum contact points be on
the Atwater-Kent K-2 system? It is on a six-cylinder car.

A repairman who specializes on repairs of electrical instru-
ments advises that the best results can be obtained by setting
the points to open about .012 of an inch and then starting
the motor. The adjustment point can then be screwed down
or up until perfect operation is produced.

INFORMATION WANTED.

Readers wishing to have queries answered should make
sure that the communication contains name and address of
the writer. We would like to communicate with the writer
of the post card signed G. R., sent from Cincinnati, O., and
dated April 6, inquiring about a Remy system.

PROPERTIES OF PHOSPHOR BRONZE.

(H. B. M., Cisco, Tex.)

In what respect does phosphor bronze differ from any other
kind of bronze?

Bronze is an alloy of copper and tin with small propor-
tions of other elements. In the year 1868 Montefiore & Kun-
zel, Liege, Belgium, discovered that by adding small propor-
tions of phosphorous, or "phosphoret of tin or copper," to
copper, that the oxides of that metal, which is nearly always
present as an impurity in more or less quantity, were deox-
idized and consequently the copper much improved in
strength and ductility. Also the grain of the fracture became
much finer, the color brighter and a greater fluidity was at-
tained. The different kinds of bronzes are produced by com-
bining such alloys as silicon, aluminum, etc.

USE OF THE DIFFERENTIAL.

(G. R., Mapleville, R. I.)

Why is it that an automobile requires a differential assem-
bly so as to allow the car to turn corners? The railroad coach
has opposite wheels securely fastened to an axle which turns,
yet curves are negotiated easily.

Railway curves are constructed with such comparatively
great radius that the wheels of the coach slip just a trifle on
the rails and thus negotiate the turn without difficulty. On
the other hand, very sharp turns are frequently encountered
in motor vehicle operation and due to the differences of the
angles at which the inner and outer wheels must travel, it is
imperative that some mechanism be used to compensate for
the difference. Slipping would not be permissible for many
reasons, such as excessive tire wear, strain on parts, damage
to highway, etc.

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ous light roadsters. You may judge their
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Roadster \$825.

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wholly to the owners of pleasure
cars.

*A quality magazine with prestige
and circulation that brings results
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TIMES BUILDING, PAWTUCKET, R. I.

(When Writing to Advertisers, Please Mention The Automobile Journal.)

NON-FREEZING SOLUTIONS.

(R. K. T., Bridgeport, Conn.)

Why is it the custom for different authorities to recommend denatured alcohol as a non-freezing solution when common table salt and calcium chloride are cheaper and have the same effect?

There are numerous chemical solutions which may be used to prevent the freezing in the cooling system, but many of them effect the metal parts. Table salt will destroy the metal of the radiator by electrolytic action, while calcium chloride will cause excessive corroding unless it be chemically pure. Alcohol is always suggested as the most satisfactory, although the most expensive, because it has no deleterious effects.

EXPLANATION OF THE HYDROMETER.

(V. J. A., Norwich, Conn.)

What is a hydrometer? I have seen this instrument referred to a number of times.

Hydrometer is taken from the Greek word meaning water measure. It is a glass tube or brass bulb which is weighted at the lower end. It has a scale on it and when placed in clear water sinks to the point marked 1.00. Fresh water is considered as the standard and the specific gravity of any fluid is its weight compared to that of water. If the hydrometer was placed in salt water, it would not sink so low, because this fluid is heavier than fresh water. If the instrument was placed in kerosene, it would sink deeper than the mark 1.00 because the oil is lighter than water.

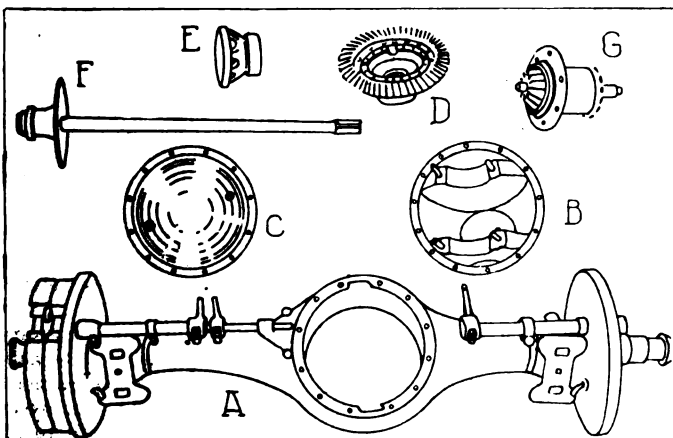
WANTS TO DISASSEMBLE REAR.

(G. L., Kinerside, R. I.)

As a subscriber I would like to ask if you could publish in your next issue of The Automobile Journal a drawing relative to the disassembling of a semi-floating type of axle. The left rear wheel of my car is very hard to turn by hand and being of a mechanical turn of mind, I wish to make this adjustment myself. The style of car which I refer to is an Oakland coupe, model 42.

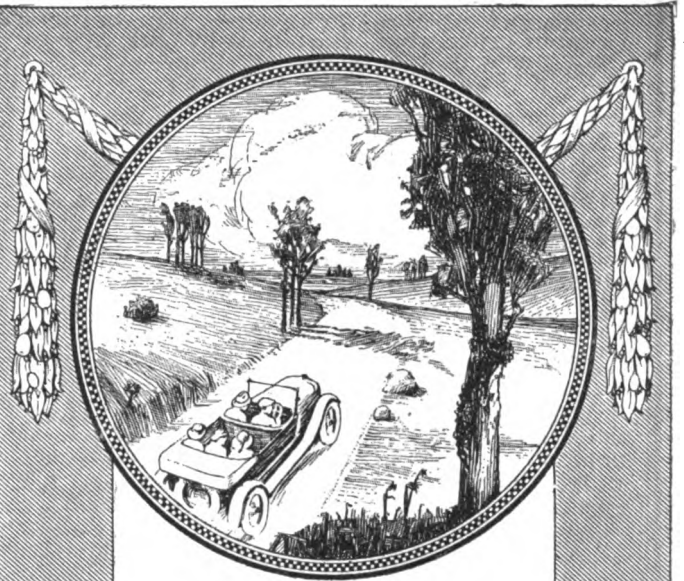
It is our belief that you are in error in regard to the axle of the model 42 Oakland being of the semi-floating type, the instruction book showing it to be of the three-quarter floating type. To disassemble this type of rear axle it will first be necessary to "break" the universal joints and remove the drive shaft. Next remove the bevel pinion by loosening the seven bolts in front of the differential housing. Loosen the bolts in the hub driving flanges and draw out both axle driving shafts. The differential mechanism can now be taken out by loosening the bolts and removing the front plate from the housing. This plate is termed the differential carrier, since it retains the differential mechanism in two bearings. A view of a disassembled rear axle group of the model 42 Oakland is shown in the accompanying illustration.

It is difficult to publish in such limited space every step



Several Members of the Rear Axle Group of the Model 42 Oakland—A, Differential Housing; B, Differential Carrier; C, Gear Case Cover; D, Bevel Ring Gear; E, Differential Bearing; F, Axle Shaft; G, Bevel Pinion.

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In the Long Run

you cannot secure satisfactory service from the best car made unless your ignition is rapid, thorough and dependable under all conditions.

Many a motorist is worrying along with a car only half efficient. Practically all motors are good and will run properly if given a chance with a really good magneto.

EISEMANN
MAGNETOS

deliver a hot spark at all speeds, insure that quick "pick-up" which every motorist so much desires, and gives your motor the chance to develop its maximum power and hill-climbing ability.

They are the most powerful, most efficient, most economical, most durable, most simple, most dependable magnetos built.

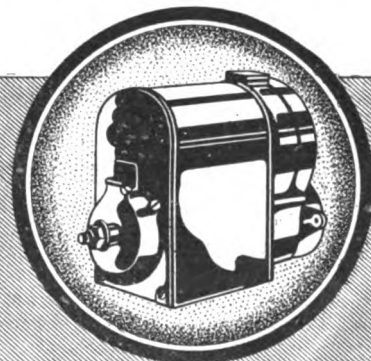
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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUG. 24, 1912, OF

THE AUTOMOBILE JOURNAL,
PUBLISHED SEMI-MONTHLY AT PAWTUCKET, R. I.

For April 1, 1916.

State of Rhode Island, County of Providence.

Before me, a Notary Public, in and for the state and county aforesaid, personally appeared William H. Black, who, having been duly sworn according to law, deposes and says that he is one of the owners of The Automobile Journal, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the act of Aug. 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business managers are:

PUBLISHER, W. H. & D. O. Black, Jr., Pawtucket, R. I.
EDITOR, W. W. Scott, Pawtucket, R. I.
MANAGING EDITOR, W. R. Bickford, Pawtucket, R. I.
BUSINESS MANAGER, W. H. Black, Pawtucket, R. I.

2. That the owners are:

W. H. BLACK, Pawtucket, R. I.
D. O. BLACK, JR., Pawtucket, R. I.

3. That the known bondholders, mortgagees and other security holders owning or holding one per cent. or more of total amount of bonds, mortgages or other securities are:

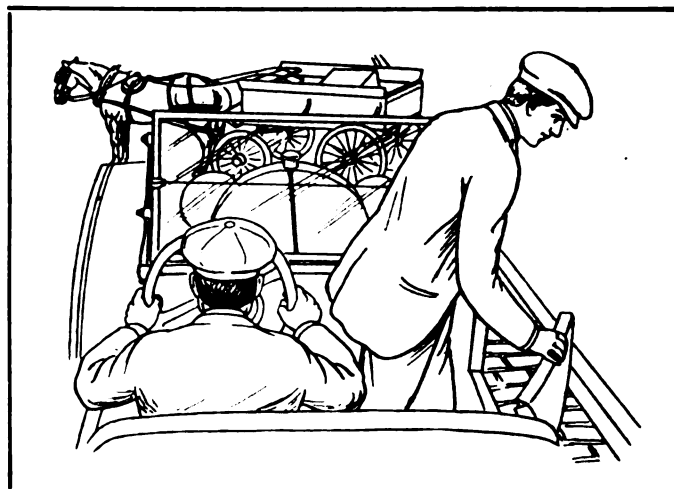
M. J. BLACK, Mortgagee, Pawtucket, R. I.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by him.

(Signed) WILLIAM H. BLACK, Co-Partner.

Sworn to and subscribed before me this 6th day of April, 1916.

(Signed) ROSCOE M. DEXTER, Notary Public.
[Seal] (My commission expires June 30, 1917.)



Left Hand Drive Affords Driver Commanding View of Oncoming Traffic.

necessary for the overhauling of the rear construction, but we are, however, the publishers of a book entitled "Motor Car Operation," which fully illustrates and explains the steps necessary to be taken.

The setting of the differential is work for an expert and if the car affords satisfactory road service it is not advisable to disturb the rear construction for such a small trouble.

FIRING ORDER OF FORD CAR.

(E. B., Newton Highlands, Mass.)

Will you please explain in your magazine the following items: How the Ford fires? Has a car with a left hand drive and centre control any advantage over the right hand drive?

The firing order of the Ford car is in 1, 3, 4, 2 rotation. The cylinder nearest the radiator is the No. 1 cylinder and is the first to fire. The next cylinders in order to fire are the third, fourth and the second.

It is contrary to our editorial policy to express an opinion relative to the advantages and disadvantages of certain types of cars. You will find significance in the fact that the majority of cars are provided with left hand drive. The reason for this is that it is the custom in this country to drive on the right side of the road. The driver being located on the left side of the car, it is much easier to watch approaching vehicles than is possible when he is seated on the right hand side. The left hand drive also makes it much more convenient for the passenger and driver to alight from the car, as shown in the accompanying illustration. Instead of being compelled to step into the roadway, he can step directly onto the sidewalk. In Europe the traffic regulations are just the reverse of American practise, as is generally the location of the driver's seat. There the flow of traffic bears to the left instead of the right, as in this country.

Some of the advantages claimed for centre control are the use of both doors and the decrease in the number of moving parts connecting the levers to the working mechanism.

WANTS TO REMOVE CARBON.

(Dr. H. J. P., Ragersville, O.)

I have a Studebaker four-cylinder touring car, 1915 model. Will you kindly inform me how to proceed to remove carbon from the valves and cylinders?

Would advise either one of two methods, oxygen or scraping. The first is the most thorough as it eliminates every particle of carbon. Many repair shops now adopt this method and the charge for the operation is not great.

To scrape the pistons and valves it would be necessary to remove the valve caps in the head of the engine. Because of the limited working space, specially shaped scrapers must be used. Even then it is almost impossible to reach every part of the piston and some carbon is almost certain to remain. You could no doubt accomplish this operation yourself. Turn the engine over by hand until the piston in the cylinder to be cleaned is brought to the height of its upward stroke. Use considerable pressure in scraping the piston



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Every Inter-State has proved its value definitely and conclusively in the hands of owners.

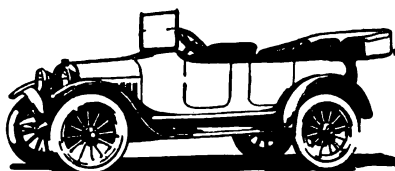
If you want to know about **proved value** and **actual assets** for either the man who buys or sells cars, write to-day.

Powerful, high speed, long stroke valve-in-head motor. Beautiful streamline body, seating five passengers comfortably. Two unit Remy electric, Starting. Light-

ing and Ignition. Over-size tires, both front and rear. Aluminum running boards. Heavily braced crown fenders. The most accessible medium priced car on the market.

Touring Car - \$2500
Roadster - \$2500
Sedan Touring - \$3000
Coupe - \$3000

**INTER-STATE
MOTOR CO.**
MUNCIE, IND.



**DIXON'S
GRAPHITE GREASE NO. 677
For Transmissions and Differentials**

Booklet No 210-G.

Made in Jersey City, N. J., by the
JOSEPH DIXON CRUCIBLE COMPANY
Established 1827

G-42

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head. After the carbon is thoroughly loosened, blow it out of the opening. Be sure to screw the valve caps down tight when replacing. A paste of flake graphite and oil smeared on the threads will insure against compression leakage and will greatly facilitate the next removal. To prevent breakage remove the spark plugs and priming cocks before unscrewing the valve caps.

If the cylinders are not heavily carbonized it may be possible to loosen the carbon by chemical action. At the end of a day's run, when the motor is hot, inject about a teaspoonful of kerosene or alcohol into each cylinder through the pet cocks on the top. Close these cocks and allow the liquid to remain in the motor over night. When the motor is started in the morning the carbon will be expelled with the exhaust gases.

STORAGE BATTERY LIGHTING. (O. S., Watertown, N. Y.)

Will you please publish the correct wiring diagram for converting gas headlights into electrical units? I wish to use a storage battery as the source of supply. Where can I obtain instruction books relative to car lighting?

A wiring plan for converting gas headlights into electrical units is shown in the accompanying illustration. The leads are easily noted, being depicted by heavy and dotted lines.

The Automobile Journal Publishing Company, which issues this magazine, is the publisher of a book entitled, "Lighting The Motor Car By Electricity." This book gives complete information regarding the installation of electric lighting systems. It contains over 210 illustrations and wiring diagrams and is very moderately priced.

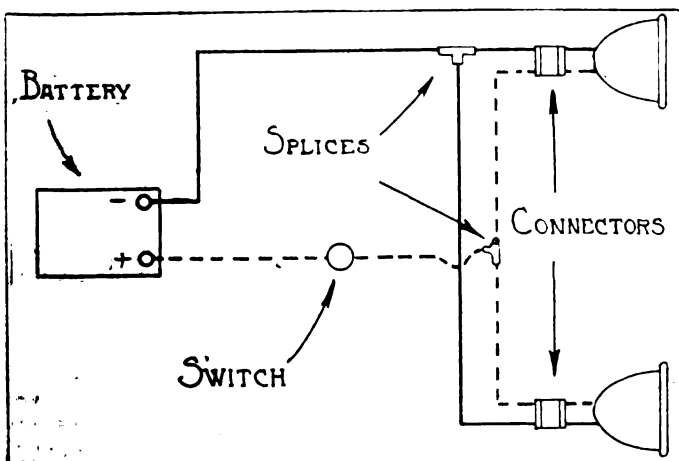
MIXING CAMPHOR WITH FUEL. (W. A. C., Boston, Mass.)

Do you know if there is any benefit to be gained by mixing camphor with the gasoline? Some motorists state that there is greater power and economy of fuel derived by its use. I do not know of anybody who is using this mixture and am skeptical about trying it myself.

The writer does not believe that there is any benefit to be derived by mixing camphor with the fuel. A few years ago an automobile engineer conducted a test, using two cars of different horsepowers. The route was up a fairly steep grade.


A mark was made at the bottom and one at the top of the incline. This grade was sufficiently steep to cause both motors to labor when picking up on the high gear. The bottom mark, in all tests, was passed at a fixed speed, as noted on the speedometer, and the rate was also observed when the top mark was passed.

In the first test, the smaller car using gasoline as a fuel, passed the bottom mark at 10 miles per hour and the car accelerated until the top mark was passed at 30 miles per hour. The test was repeated and the result was the same. The second test was made with the same machine, but the fuel contained one-quarter ounce of camphor to each gallon of fuel. Repeated tests with this mixture showed that there was



Wiring Diagram for Headlights Using Storage Battery as Source of Current.

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THE STANDARD LUBRICANT FOR EVERY MOTOR

Automobile construction is now largely standardized—and the lubricating needs of the standard makes are identical. That is why

Polarine

has the endorsement of owners of every type of car. Polarine lubricates any kind of motor—all the time. It protects the moving parts and prevents scored cylinders and burned out bearings. It is the summer lubricant which lubricates. It leaves practically no carbon.

Look for the SOCONY sign on garages everywhere. It is the sign of quality.

STANDARD OIL CO. OF NEW YORK

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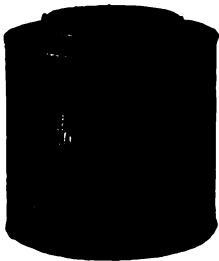
Albany
Boston

When You Need Lubricant *Most* Common Greases Are Not Working

The first few "friction moments" of starting bring greatest pressure on bearings and gears. With these starting strains comes most destructive wear. Just *then* ordinary greases are *not* lubricating. *They must first be melted by heat* of bearings or gears.



Starts lubricating the instant your car moves from rest. It keeps on lubricating every minute your car is running. You absolutely know that every part is kept apart *always* by this non-solidifying, non-melting film of friction-preventing lubricant.

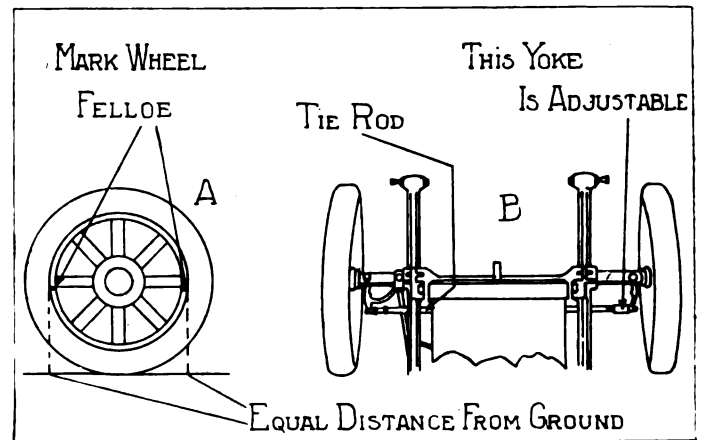


Non-Fluid Oil is a special-process lubricant that takes the place of grease in transmission, differential and all bearings. It lasts *three times* as long, yet costs no more. So why *shouldn't* you use it?

Your dealer sells it. Look for the orange-colored can.

Write for samples and literature.

N. Y. & N. J. Lubricant Co.
165 Broadway, New York



A, Mark Wheel Felloe at Front and Back and Equal Distance from the Ground; B, Front Wheel Assembly.

absolutely no difference in the power of the car, it passing the bottom mark at 10 miles per hour and the top mark at 30 miles per hour. A third test was then made, the gasoline being camphorized to the extent of half an ounce to the gallon of gasoline. The results were exactly the same as before. Tests made with the larger car produced similar results as to efficiency.

Economy tests were also held and it was found that more mileage to the gallon was developed with gasoline than with the camphorized fuel.

WANTS TO ALIGN FRONT WHEELS. (M. M., Brooklyn, N. Y.)

Kindly give full instructions as to truing up and keeping front wheels in alignment. Also the correct pitch of front wheels.

It is good policy to test the alignment of the front wheels at least once a month. Beside accidents, the striking of large stones, deep ruts and contact with the side of the curb stone are apt to be the cause of these being out of true. There are several methods of aligning the front wheels, but the one shown in the accompanying illustration is no doubt as simple and accurate as any. At A is shown the inner side of the wheel. At an equal distance from the ground and as near to the centre line of the wheel as possible scribe a line on the wheel felloe. This line should ordinarily be on the dead centre line of the wheel, but generally the frame and the dust pan prevent the extending of a gauge between the wheels at this distance and so the marks have to be placed a trifle lower. Mark the inner side of both front wheels in the same manner. The alignment is reached when the distance between both front marks is the same as the distance between the two rear marks.

Let us consider now that you have ascertained the distances between marks and have found that there is a greater distance between the rear marks than there is between the two at the front. You will find upon inspection that the two steering knuckles are connected by a rod which is commonly termed the tie rod. One end of this rod is adjustable, it having threads and the connecting yoke being screwed on. The remedy is to take out the retaining pin, force the tie rod off the steering knuckle and screw the yoke further on the rod. The principle is obvious. Screwing the yoke further on the rod shortens the rod and draws in the rear of the wheels and forces the front of the wheels out. Shorten the rod a little, at a time and each time test the alignment by the method already suggested. If it is found that there was a greater distance between the front marks than the rear marks, the remedy would be the reverse, lengthening the tie rod.

Many experts advise a slight toeing in of the front wheels to assist steering. That is, there should be slightly less distance between the front marks than between the rear ones. It is not advisable to have the distances between the two groups of marks exceed $\frac{1}{8}$ inch. At B is shown the assembly of the front wheels.



HEINZE



(When Writing to Advertisers, Please Mention The Automobile Journal.)

MIXING ETHER WITH GASOLINE.

(W. D. R., Furlong, Penn.)

Being a subscriber to your publication, I would like you to state in the reader's columns of the next issue, how much ether can be put in five gallons of gasoline for a four-cylinder motor having a 3 1/16-inch bore and a four-inch stroke. I hear that others are using it and would therefore like to know the quantity to use to make a safe mixture.

Also an easy method to copper coat so that I can nickel plate.

The mixing of ether with gasoline was referred to in the last issue of The Automobile Journal, April 10, on page 44. Since the mixing of fuels is seldom done there is no standard rule for the percentage of ether which should be used.

A simple method of copper coating metal so that it can be nickel plated is to dip the parts in a blue vitriol solution. The mixture is obtained by dissolving one part of blue vitriol in three parts of water. It is said that the copper formation can be seen plainly by the work man.

DOUBLE INTERNAL BRAKES.

(R. K. L., Pontiac, Mich.)

Being a subscriber to your journal, will you kindly state what is meant by the double internal type of brake?

Brakes are said to be either of the expanding or contracting type. You no doubt know that the braking action is accomplished by a band being brought to bear against the steel drum carried by the wheel. The double internal type of brake is an assembly which has both the service and the emergency brake within the steel drum.

At A, in the accompanying illustration, is shown an example of this type of brake. Both bands are designed to expand to apply the pressure to the inside of the drum. The outside one, nearest the wheel, is the emergency brake, and is controlled by a hand lever. The other is the service brake and is controlled by a foot pedal.

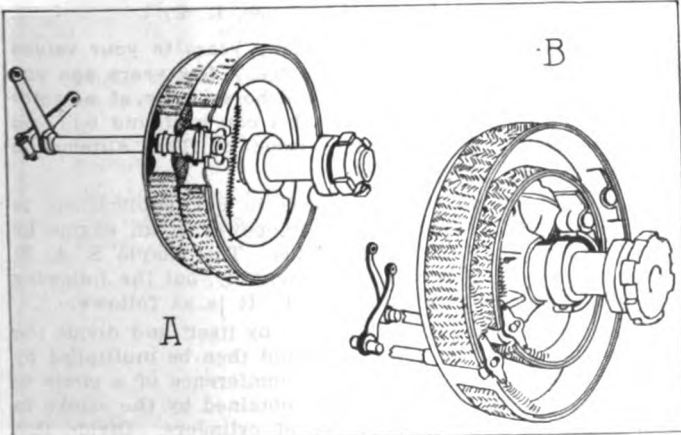
Another type of double internal brake is illustrated at B. Both bands are expanded. Though the action is similar to the above this type differs in that two drums are carried on the wheel. The smaller band is used for emergency purposes, while the larger one is the service brake.

FIRING ORDER OF ENGINE.

(R. K., New Haven, Conn.)

I have a 1913 Model B — car. Because of worn insulation I removed the cables from the commutator and I do not know how to replace them. I have tried several ways, but the motor will not start. Any enlightenment given on the subject will be appreciated.

The firing order of your engine is 1-2-4-3, starting with the cylinder nearest the radiator. To retune the ignition, turn the motor over by hand until the piston in No. 1 cylinder is at the height of its compression stroke. Now turn the engine over again until the piston descends on the firing stroke about a half inch. Remove the cover of the commutator and note the segment in the shell with which the roller is in contact. The cable leading to the first cylinder should be fast-



A, Double Internal Brake Uses Single Brake Drum; B, Type of Double Internal Brake Requiring Two Brake Drums.

(When Writing to Advertisers, Please Mention The Automobile Journal.)

Watch the May 25th issue of this Magazine for important announcement of

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In the meantime write for our new catalogue—with complete specifications. Just out.

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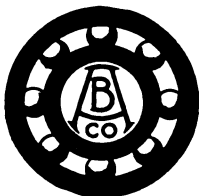
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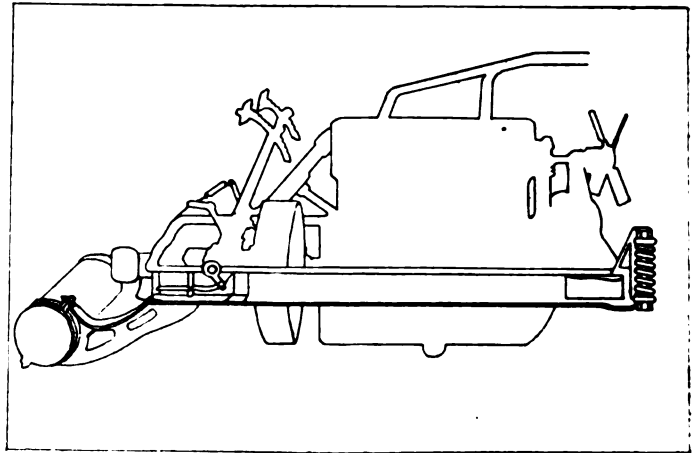
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"Floating Power Plant" Construction Used in the United States Motor Trucks.

ened to this segment terminal. After this terminal is determined, the operation is simple, bearing in mind that the terminals in order of rotation supply current to the second, fourth and third cylinders respectively.

METHOD OF ENGINE SUSPENSION.

(T. S., Providence, R. I.)

I have been a subscriber to your valued publications for a number of years. Engaging extensively in the trucking business, I would like you to describe if possible what is meant by the "floating power plant" as used in the United States motor trucks.

The floating power plant is an exclusive feature of the United States motor trucks. A sketch of this design is shown in the accompanying illustration. The engine, clutch, muffler and other parts are bolted to a sub frame. This frame is attached as close to the engine as the flywheel will permit. It will be noted that the three-point suspension principle is followed and that the front of the sub frame is supported by coil springs. The brackets on the truck frame are secured between these springs, thus cushioning the upward and downward action of the engine.

At the other end of the sub frame is a five-inch ball, which mounts the rear end of the sub frame on a cross member of the main frame. It is obvious that this construction permits the twisting of the main frame in every conceivable direction without straining the sub frame or the engine.

The United States Motor Truck Company announces that a new catalogue has just been received from the press and will be sent on request to any person, whether dealer, user, driver, or one merely interested in the unique constructional features of the truck. There is a complete description and illustrations of the "floating power plant."

HORSEPOWER BY FORMULA.

(Dr. R. H. S., Providence, R. I.)

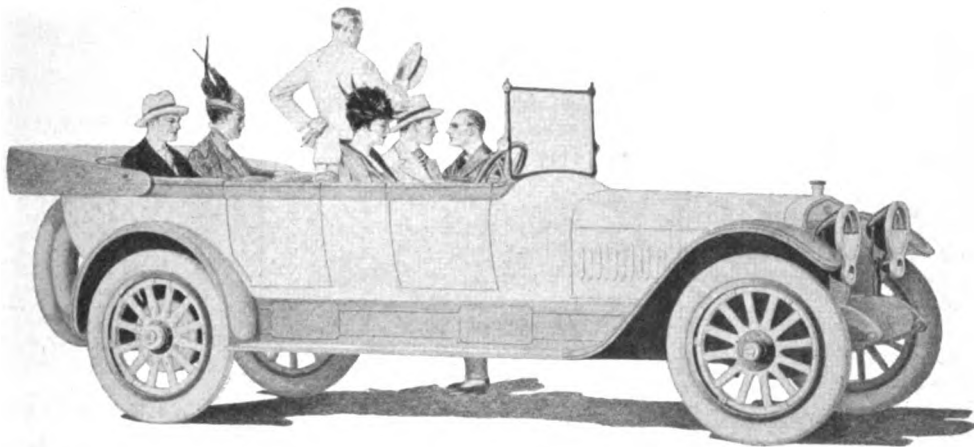
I have been a subscriber for many years to your valued publications. If I remember correctly, a few years ago you published a formula for finding the horsepower of a motor which considered the stroke. If this can be found will you please republish it in an early issue of The Automobile Journal?

Several formulas have appeared in our publications in the past for the finding of the horsepower of an engine by taking the stroke into consideration. The simple S. A. H. formula can usually be computed mentally, but the following one is somewhat more complicated. It is as follows:

Multiply the bore of the cylinder by itself and divide the product by four. The quotient should then be multiplied by 3.1416 which is the ratio of the circumference of a circle to its diameter. Multiply the product obtained by the stroke in inches and then by the number of cylinders. Divide this product by 10, and the result will be the theoretical horsepower of the engine.

(When Writing to Advertisers, Please Mention The Automobile Journal.)

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There are two classes of automobile makers. One class treats you *not* as a person having individual personal desires, but merely as part of a mass, simply as a Number. 🐾🐾🐾 Buy from such a maker, and you are not allowed to express the slightest personal wish as to how your car shall be made or how it shall look. You must take what that maker turns out of his hopper. 🐾🐾🐾 The other kind of maker knows you *are* a human being with personal tastes distinctly your own. These makers produce superior cars, because men and women of taste are accustomed to the best the world produces and insist upon highest quality. And these superior cars are always individually finished to meet the precise requirements of the buyer's exclusive needs and wishes. 🐾🐾🐾 When you buy a Winton Six, you secure a car superior mechanically, and of precisely the beauty you most admire. 🐾🐾🐾 Let us talk it over with you.

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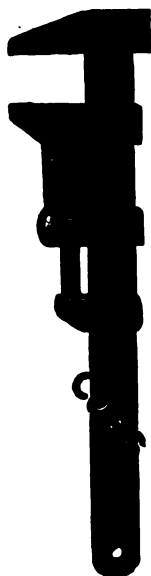
The material is selected with the same care, made by equally experienced and trained wrench makers, in a factory which specializes in wrench making. The wrenches are finished carefully and many times tested to assure the quality that will meet every requirement placed upon them.

Car owners who know wrench values demand the Coes. It is most popular with automobile repairmen, and in every other line of mechanical work Coes Wrenches will be found on the benches and in the tool kits of the expert workmen.

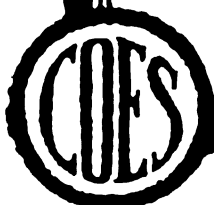
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These have been revised and corrected by the makers, the new prices, the recently announced models, and all other data on the subject. Every man in the trade must have this information—he uses it constantly in his business.

This information, so complete, so up-to-date has never before been published in any issue of any magazine. It will be a buyers' reference guide, kept and referred to, thousands of times during the year to come.

What is this information worth to you—\$5, \$10 or \$25?

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It will have the largest distribution to trade interests ever afforded by any one edition of a motoring publication.

Circularization of 30,000 concerns by mail would cost 10 times the charge for a full page advertisement in this edition.

Those who advertise accessories, parts and fittings for Ford cars in special magazines are neglecting what should be the greatest market. In this magazine they can reach all, including Ford, dealers. Why limit selling opportunities when all trade buyers can be reached in the Accessory and Garage Journal.

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Entered as second class matter, April 15, 1906, at the Postoffice at Pawtucket, R. I., under Act of Congress of March 3, 1879

VOL. XLI.

MAY 10, 1916.

NO. 7.

The Publisher's Comments.

FOR Several Years Past the Editors of this magazine have made a practise of publishing in one issue of The Automobile Journal a great volume of data concerning the best routes for motor tours. The issue has become known as the Annual Touring Number, and, this year, as in the past, will be issued July 10. The touring information is national in scope and is profusely illustrated with choice views of historic and scenic spots along the routes. Each tour is supplemented with accurate itineraries and a general index whereby the reader can lay out a tour in any part of the country he desires. This number will be one of the most important of the year.

Next in Importance to the Touring Number is the current issue. It is seldom that such a wealth of practical information pertaining to preparing the car for a season's service can be found in a single number of a magazine. The suggestions not only afford the owner opportunity to make his car ready for the road, but also to maintain it throughout the season, so that he can obtain the maximum of service from it. The reader should not overlook the accessory and equipment department, in which can be found descriptions of a large variety of devices designed to make overhauling and maintenance easy and economical.

The May 25 Issue will contain a feature story concerning the Indianapolis Sweepstakes, which bring to the reader the news of the meet just prior to the start on Memorial Day. This race promises to be one of the most important and sensational ever held in the Middle West, among the 30 entrants being several of the racing stars who have thrilled two continents. Among other things the story will present authentic and interesting sketches and illustrations of the drivers and their cars, a survey of the previous meets and their results, and shrewd prognostications as to the probable winners.

As An Educational Feature the Suggestions for the Ford Car Owner have proved to constitute one of the most interesting and instructive discussions ever published on the subject of the operation, care and repair of the Ford automobile. This issue contains the eighth of the series devoted to the adjustment, restoration and overhauling of the machine and presents information and illustrations that have never been published in this country before. Each component and phase is treated exhaustively and in a manner that exhibits a desire on the part of the writer to be of the greatest possible service to the readers of The Automobile Journal.

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A description of the new plant of the Standard Woven Fabric Company, Maker of Multibestos.
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In this article the reader is told the right degree of attention to give the car's tires.
- The Reader's Correspondence Department.....62**
Wherein practical answers are given to inquiries concerning the operation of motor vehicles.

MICHELIN

THE SATURDAY EVENING POST



2 page spread in issue of April 8th

Two of the series of big Michelin advertisements now a feature of the Saturday Evening Post.

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Issue of
April 29th

MICHELIN



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Roadster, \$595
fah, Toledo

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The mother of that family enjoys a new freedom which makes her a better wife and mother.

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They all lead a bigger, broader, healthier, happier, more united family life.

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This Overland costs only \$615.

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PRICE**

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MAKE THE NEW PRICE POSSIBLE.**

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PRICE**

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There is a size for every motor.

There is a special model for Ford cars.

If your dealer cannot supply you promptly order direct.

Correspondence invited. Detailed information at request.

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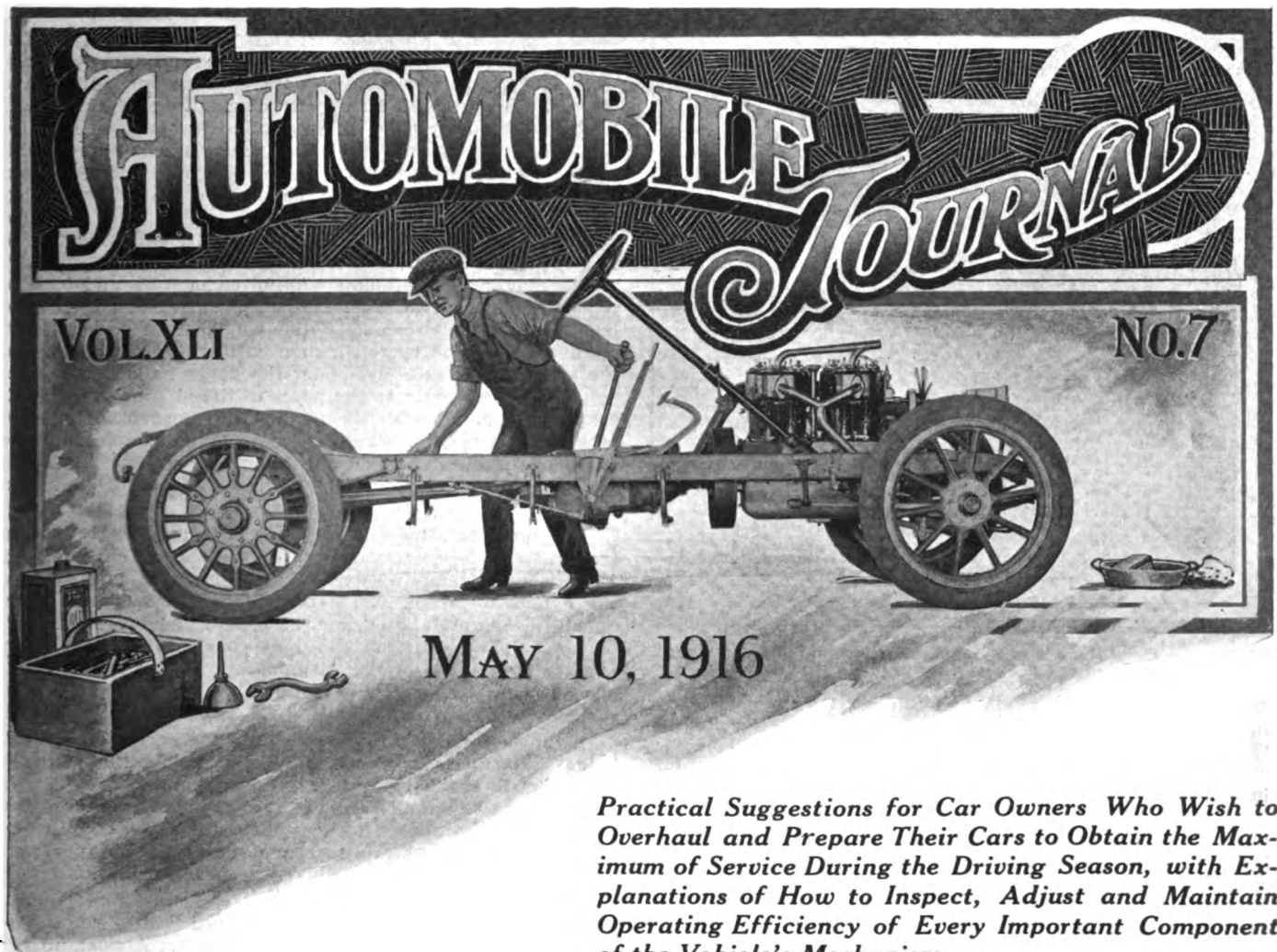
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Practical Suggestions for Car Owners Who Wish to Overhaul and Prepare Their Cars to Obtain the Maximum of Service During the Driving Season, with Explanations of How to Inspect, Adjust and Maintain Operating Efficiency of Every Important Component of the Vehicle's Mechanism.

Making the Car Ready for Summer.

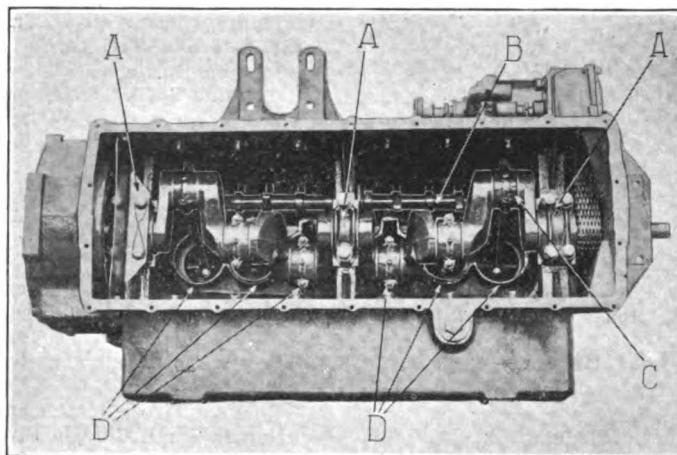
A NOTABLE feature of the beginning of the 1916 driving season is that the number of motor car owners who are intending to overhaul their cars themselves is much larger than ever before. This is due partly to the average motorist's greater familiarity with the mechanism, which in itself is due in large measure to the comprehensive educational propaganda conducted by the car and equipment makers. Another factor to be considered is that the mechanism generally has been simplified and made "fool proof."

While during the winter months, especially in the northern tier of states, a very large proportion of motor cars are always laid up because of the condition of roads, there have been more inactive pleasure vehicles during the past three or four months than during any corresponding period in recent years. The cause for this has been generally attributed to the unusual severity of the weather and to the high cost of gasoline. As regards the latter cause, every indication is that fuel will soon be selling at about the same levels as during last spring and summer, which will allow a greater number of motorists to put their cars into service than would be

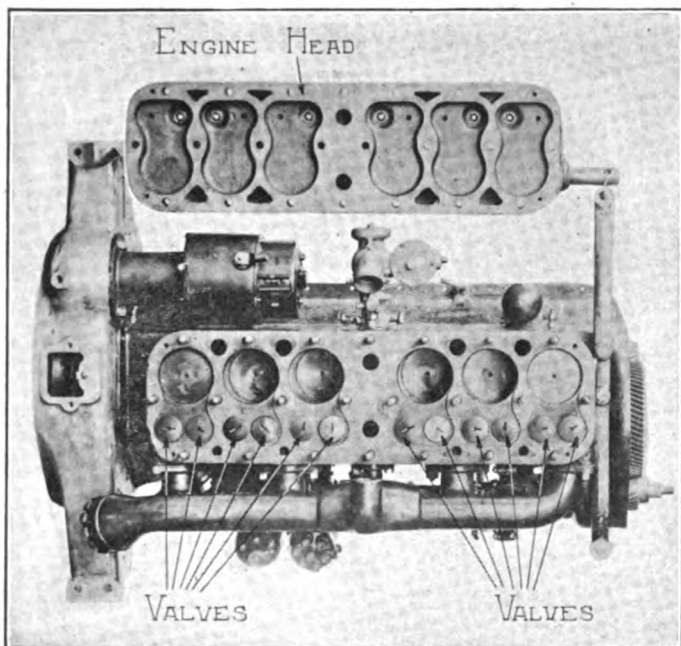
the case if the prices were maintained at the high marks reached in March of this year.

Every car owner who intends to operate the car that he used during 1915 should examine, adjust and clean every component before taking the machine out on the road. This is imperative if the car has been used hard during the past season, and is advisable even if it has not been subjected to continuous service. The owner who realizes this and follows the advice will have a machine which will be capable of giving satisfactory service and in which he will feel pardonable pride. On the other hand, the motorist who does not attend to the machine at this time, when the car is not in such constant use as it will be later in the season, will probably find that his maintenance, operating and repair bills are far more than they would be if the machine had been put into operating condition at the outset.

Experience has taught most car owners that even if the car has not been in actual dead storage during the winter months, a thorough inspection and cleaning of the different parts is desirable at least once a year. The beginning of the driving sea-



As Interior of Motor Appears with Lower Part of Crank Case Removed; A, Main Bearings; B, Camshaft; C, Crankshaft; D, Cylinders.



If the Engine Head Is Removable, Carbon Can Easily Be Scraped Out, as the Pistons and Valves Will Be Exposed.

son, or early spring, is, therefore, the logical time for such an operation. If the car has been in dead storage the owner should afford it greater care during the general inspection than would the operator who has had his machine in continuous service throughout the year. The reason for this is that the driver of the latter car is thoroughly acquainted with its operating condition and throughout the winter has at different times made such minor repairs as were necessary for smooth operation.

The reason for publishing this article is to extend aid to car owners who have sufficient confidence in their ability to perform every necessary operation. The parts requiring attention are treated in a systematic manner and if the suggestions are followed should result in the car being placed in a good operative condition.

To begin the discussion, let us first consider the motor, as usually this is the first component turned to by the profes-

sional repair man when making an overhaul. If the car is in fairly good condition it is safe to state that the necessary work can be done without removing the engine from the chassis. Before considering the dismantling of the power plant, it will be well to briefly outline the tools needed for the work. The equipment should include a set of standard S wrenches, files, screw driver, carbon scrapers, pliers, Stillson pipe wrench, large monkey wrench, punches, hacksaw, soldering outfit, hammer, brushes, washers, cotter pins, nuts and bolts of different sizes, grease gun, vise, small breast drill, valve lifter and emery cloth.

Overhauling an automobile is not clean work and for this reason it is only with considerable difficulty that anyone who handles machinery can keep the hands clean and soft. A method much used by repair men is to rub soft oil soap into the pores of the skin and under the finger nails before commencing operations. As the pores of the skin are filled with soap it is impossible for them to become clogged with dirt or other foreign matter. When the operation is completed, place the hands in clean water and rub together so that a lather is formed. The hands can then be washed in the ordinary manner.

The first operation on the motor is to remove the carbon from the cylinders and valves. The presence of carbon is objectionable for many reasons. Due to the rapid explosions in the cylinders carbon will become incandescent and consequently cause preignition, knocking, loss of power, overheating and other conditions too numerous to mention. Carbon is the embryo of the diamond. If a diamond will cut glass, consider the effect that carbon has on the highly glazed surfaces of the cylinder walls.

If the motor has a removable head the access to the cylinders is comparatively easy. When scraping the piston it should be at the height of its compression stroke. This is the period in which all valves of that cylinder are closed and there can be no danger of scratching their faces with the scraper. Do not be afraid to bear down on the scraper, as a scratch on the top of the valves or piston will not lessen operating efficiency.

When the power plant is not equipped with a removable head the operation is slightly more difficult. Almost all motors, however, have removable valve caps and these should be taken off and the scraper inserted through the openings. To reach the piston head, special shaped scrapers may be needed. Take care that the piston is at the top, as the scraper is apt to scratch the finely finished cylinder walls. When the

SCHEDULE OF STEPS NECESSARY FOR THOROUGH INSPECTION.

Power Plant.

- Clean Circulation System.
- Remove Old Oil from Crank Case.
- Flush with Kerosene.
- Adjust Bearings
- Remove Carbon.
- Test Valves.
- Grind Valves.
- Retime or Check Valve Timing.
- Clean Carburetor and Fuel System.
- Clean Spark Plugs.
- Examine Gaskets.
- Inspect Wiring and Terminals.
- Tighten All Nuts and Bolts.
- Replace Old Oil With New and Test Level.
- Examine Water Connections.
- Lubricate All Moving Parts.

Clutch.

- Examine Bearings for Wear.
- Inspect Clutch Facing.
- Flush Multiple Disc Type with Kerosene.
- If Plates Operate in Oil, Use New Lubricant.
- Adjust Clutch Spring or Springs.

Transmission.

- Remove Old Lubricant.
- Inspect Gears and Bearings for Wear.
- Adjust for End Play.
- Refill Housing with New Lubricant.

Differential.

- Remove Old Lubricant.

Determine Relationship Between Ring Gear and Driving Pinion.

- Try Drive Shaft for End Play.
- Refill Housing with New Lubricant.

Rear Axle.

- Examine Brake Linings and Renew if Necessary.
- Test and Adjust Both Brakes Separately.
- Renew Felt Washers if Worn.
- Examine and Clean Bearings.
- Pack with Lubricant.
- Tighten Radius Rods, Truss Rods, Nuts, Etc.

Front Axle and Springs.

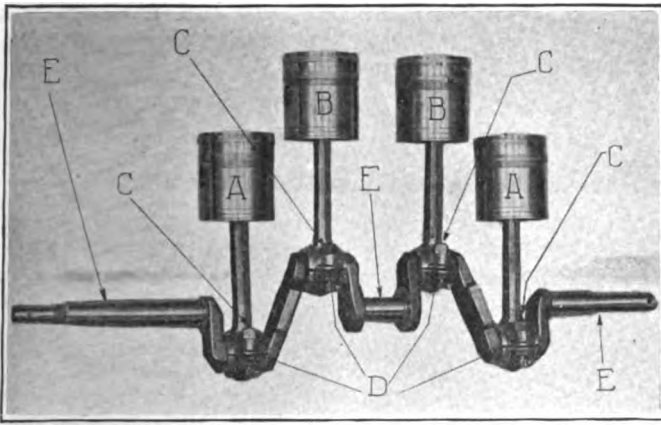
- Tighten Spring Clips.
- Examine Spring Shackles for Wear.
- Test Alignment of Wheels.
- Inspect Steering Linkage.
- Examine, Clean, Lubricate and Adjust Wheel Bearings.
- Test Steering Knuckles for Play.
- Fill and Screw Down All Grease Cups.
- Insert Graphite Between Spring Leaves.

Steering Gear.

- Test Wheel for Looseness.
- Examine All Connections.
- Adjust Bearings.
- Renew Lubricant and Replace Grease Boots.

Tires.

- Remove Tires, Scrape and Graphite Rims.
- Repair Small Cuts in Shoes.
- Place Talc or Flake Graphite Between Tube and Shoe.
- Replace Any Worn Links in Tire Chains.



Showing the Crankshaft Assembly; the Cranks Are So Arranged That the Two Middle Pistons, B, Are at the Top of Their Strokes When the Two End Pistons, A, Are at the Bottom; C, Bolts Which Retain Connecting Rods to Crankshaft; D, Shims for Adjusting Play; E, Main Bearing Journals.

carbon is thoroughly loosened, blow it out with air pressure, through the valve cap openings.

To insure against compression leakage, the valve caps are always screwed down as tightly as possible. If they have not been moved for a considerable period they often become set and it is almost impossible to turn them. Do not be easily discouraged. Increase the leverage on the cap remover or tap the projections in the cap with a blunt punch and hammer.

Regarding the Valves.

As regards the valves, they should be replaced in the same seats from which they were removed, and for this reason they should be arranged on the bench in the order in which they were taken out. Beside each should be placed its spring and retaining washer.

One of the commonest mistakes made by the motorist is the attempt to seat a valve which has a warped head, bent stem or badly pitted face. Regardless of the time spent in grinding, it is practically impossible to obtain true seating under these conditions. Another mistake is the applying of pressure to the valve grinding tool so as to quickly wear away the rough surfaces. While in some instances pressure is apt to quicken the action, there is great danger of the grinding compound scoring both the valve face and seat.

Repair men advise that before attempting to reseat a valve, catch the stem in the chuck of a drill or lathe and then start the machine. If any part is warped it will be shown by irregular rotation. Some skilled work men can straighten the valve so that it will be fit for operation, but the best advice which can be given to the motorist is to replace the faulty valve with a new one.

A valve that has been in service for some time is subject

to wear at several points. If there is not an accurate register between the valve face and seat, a shoulder will be worn on the face. This can be removed by filing the face, using a very fine file for the purpose. If the valve stem has been subject to severe stresses against the valve stem guide, the stem will be worn to an oval shape. This condition permits the suction stroke of the piston to draw air into the combustion chamber. The extra air, of course, dilutes the mixture and weak explosions are the result. This may not be as noticeable at high speeds as it is at low speeds, due to the large amount of gas used at high speeds. When the valve stem is found to be worn, it is evidence that the valve guide is also worn. If the guide is removable, it is the best plan to force it out and press in a new bushing. The guides are, however, frequently cast integral with the cylinder and the only remedy possible is to drill them larger and then fit in steel bushings.

For the sake of quietness, fibre inserts are frequently used in the top of the adjustable nut of the valve plunger. Continued tapping against the end of the valve stem causes a recess to be worn in the fibre insert. Many times the insert can be reversed, but if not, new fibres should be used. On several of the earlier types of cars the adjustable type of plunger is merely a hardened steel nut. Should a recess be worn in it, remove the nut and grind the surface flush. Adjustment can be made to compensate for the metal removed.

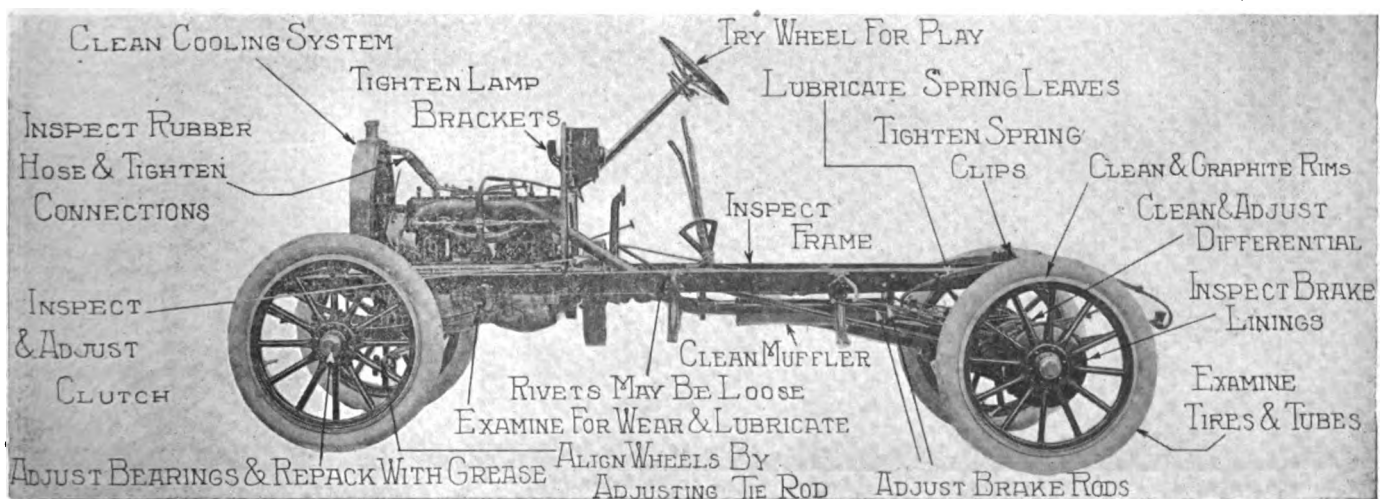
How to Grind Valves.

Valve grinding is not a difficult operation, but one which many times becomes tedious. It is at such times that the patience of the operator is tried and he is inclined to use more pressure on the grinding tool to quicken the work. Only sufficient pressure to hold the valve against its seat should be exerted. To start the operation a paste made of medium emery and oil can be used between the valve and its seat. Place a piece of cloth between the valve chamber and the piston so as to prevent any of the grinding compound from reaching the bore. The abrasive should be renewed from time to time and the valve and seat thoroughly washed each time with gasoline. Continue the grinding action until a bright ring appears on the entire circumference of the valve face. When a smooth job is required a paste made of ground glass and oil should be used after the emery.

After replacing the valves in the cylinders, make the adjustment between the push rods and the valve stems. To insure an even distribution of power and quietness of operation, there must be close relationship between these parts. The clearance between them should be about the thickness of an ordinary name card when the piston is at the top of its compression stroke. The adjustment can be made by loosening the lock nut on the plunger and turning the adjusting screw to the left. When the proper relationship has been obtained, tighten the lock nut.

Graphite Prevents Freezing.

Before replacing the valve caps on the top of the cylinders, scrape the carbon from the interior and coat the threads (Continued on Page 16.)



Typical View of a Stripped Chassis, Arrows Indicating a Number of the Parts of the Mechanism Which Will Require Attention During the Overhaul.



THE Mitchell-Lewis Motor Company is producing this spring a new last-minute model of its "Six of 16," which is already very popular. To this car have been added 26 minor features, many of which will prove very attractive to buyers. They have been paid for, the company declares, out of improvements in the efficiency of the factory.

The most noticeable improvements are refinements in the body, which enhance its appearance and add greatly to convenience. There are also changes that improve the simplicity and attractiveness of the motor, and a few others in the chassis.

One of the most noticeable of the new features is the adoption of the double cowl type of body, producing an almost perfect streamline. There is no question regarding the great popularity of this design; the number of cars on which it is used has increased enormously during the past few months.

In the instrument board immediately in front of the driver, and easily reached,

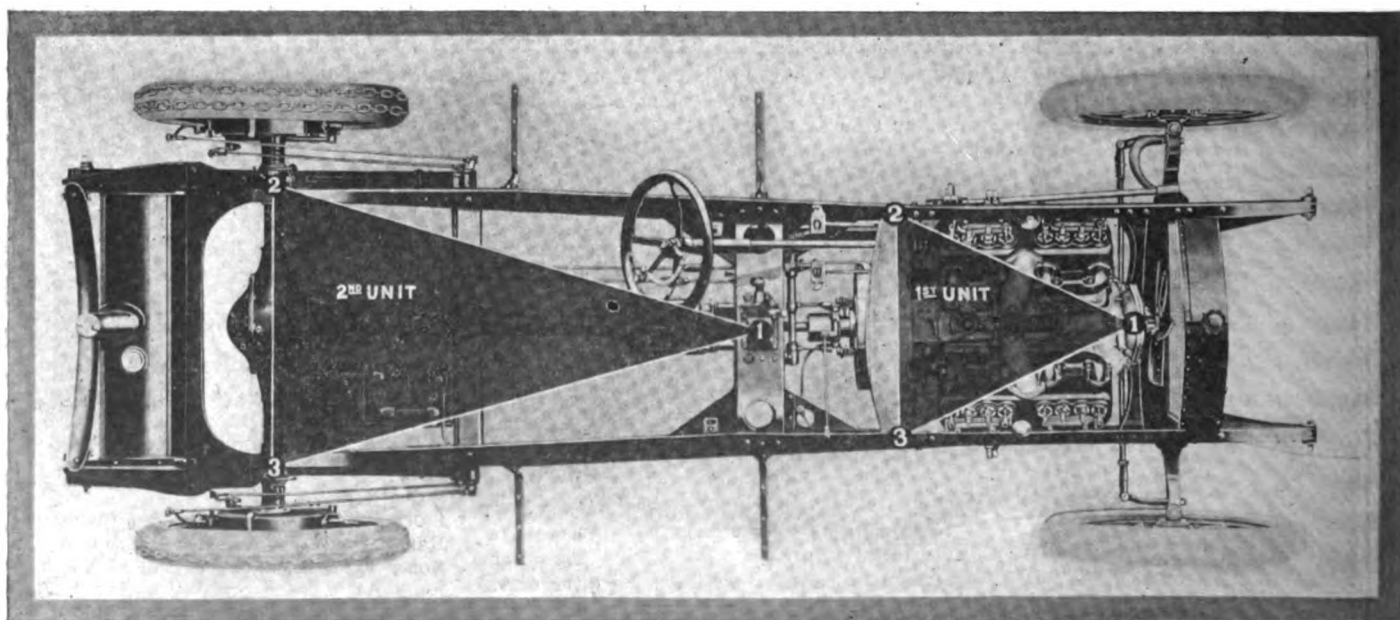
CHASSIS DETAILS OF THE MITCHELL SIX

Make of motor.....	Mitchell
Shape and cast.....	L-en bloc
Cylinders	Six
Bore and stroke.....	3½x5
Horsepower (S. A. E.).....	29.40
Piston displacement....	212 cu. in.
Cooling system.....	Pump
Lubrication.....	Splash pressure
Ignition	Single
Carburetor	Rayfield
Clutch	Cone
Gearset.....	Selective, three
Wheelbase.....	127 inches
Wheels	Wood
Rear springs.....	Cantilever
Steering and control..	Left, centre
Rear axle.....	Floating

is a small locker compartment, which locks with the same key that is used for the ignition and lighting switches.

In the back of the front seat is an electric light for illuminating the tonneau on dark nights. It is covered with a ground glass which sets flush with the surface of the back. In the back of this seat is also a compartment into which the extra seats in the seven-passenger car fold when they are not in use. They are handsome and amply large for comfort. When they are being used the compartment in the rear of the back seat provides four inches of extra leg room for the extra passengers.

One of the new features is an engine priming pump, which facilitates starting in extremely cold weather. This is mounted on the instrument board and is also part of the regular equipment. Handles are provided on the sides of the windshield and are designed for use by the passengers of the front compartment in assisting themselves in and out of the car.



The "Bate Two-Unit, Three-Point Suspension" Construction of the Mitchell Chassis, in Which the Engine and the Transmission Attached to the End of the Torque Tube and the Rear Axle Form Distinct Units, Both of Which Are Suspended at Three Points.

Instead of the old style metal robe rail will be found a black strap which matches the remainder of the upholstery.

An important convenience for the driver is an engine driven tire pump which has been added to the equipment. It is mounted in the new model immediately behind the fan and is driven from the fan shaft. The location also enables the fan to cool it when it is in operation.

The headlight mounting is original. The lights are mounted rigidly to the removable black enamel radiator shell. These lamps are reversible so that they can be turned backwards to illuminate the road behind when the car is backing

sorber and produces another improvement in riding quality.

Although the increase in wheelbase has given the car the appearance of a larger and more substantial vehicle, the weight has still been held down to less than 3000 pounds.

The radiator has been built higher to fit better into the new body lines. The five-passenger model does not differ from the seven except that it is not equipped with the extra seats. The top is similar to that used in the preceding series. It is the one-man type with Jiffy side curtains, which when not in use are neatly carried in an envelope at the rear.

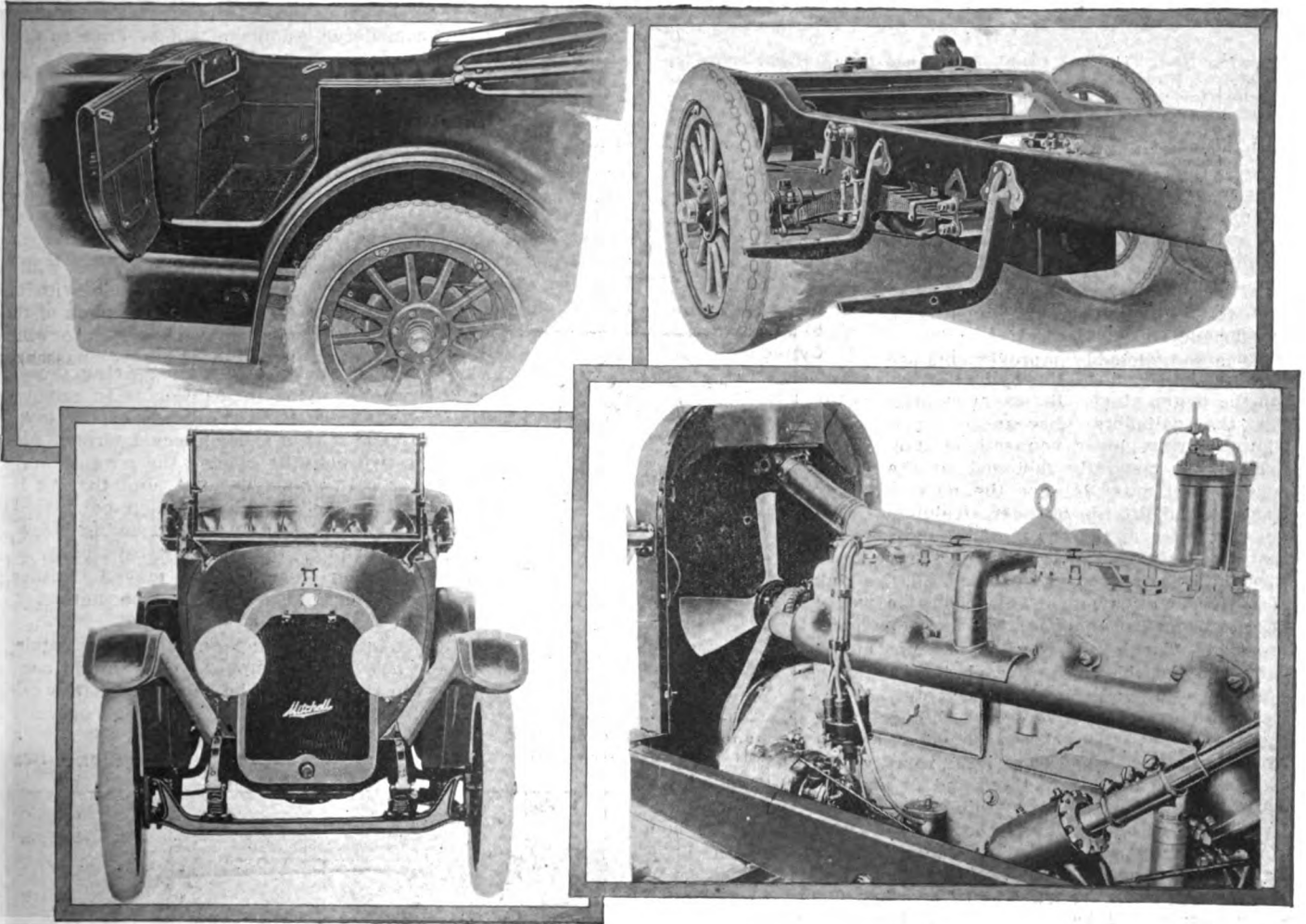
The chassis maintains the three-unit,

and the attachment of the Rayfield carburetor directly to the block. Lubrication is of the constant level splash type. Oil is added through a filler cap, which is easily accessible at the dash.

This new six car sells for \$1325. The eight chassis has not been changed, but it is equipped with the same body as the six. The price is \$1450.

BREAK AUSTRALIAN RECORD.

The record for the 570 miles from Melbourne to Sydney, Australia, was recently broken by Boyd Edkins in a Vauxhall 16-20 horsepower car. He made the



Some of the Mitchell Features—Upper Left, Compartment for Extra Seats and Electric Light; Upper Right, Lengthened Spring Assembly; Lower Left, View Emphasizing Beauty of Body Lines and High Radiator; Lower Right, View of Power Plant, Showing Mounting of Generator and Distributor, Which Eliminates Use of Silent Chain.

or turning, and they are also useful in providing light for a tire change or while making adjustments to the motor or parts of the chassis at night.

Improvement in the riding quality of the car has been accomplished by adding two inches to the cantilever springs in the rear and also by an increase of two inches in the wheelbase, which is now 127 inches. The springs measure 52 inches. The larger body enables the passengers to ride more comfortably in a larger tonneau.

The front springs have been perfected by the use of a rebound plate which has been built into the spring itself. This has something of the effect of a shock ab-

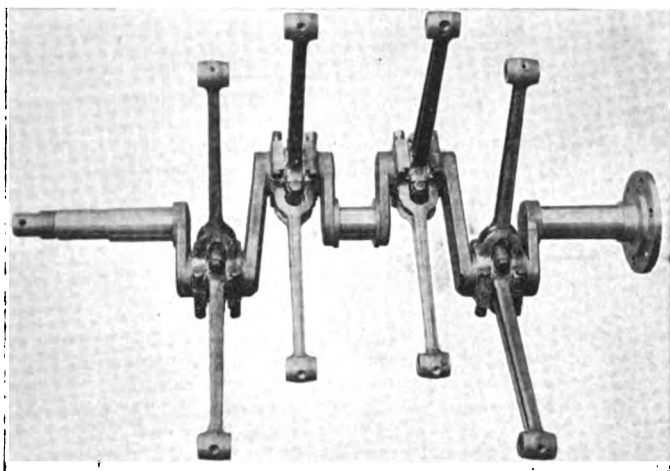
sorber in which the transmission is at the end of the torque tube and is supported at three points, as is the motor.

The engine changes include the adoption of the two-unit electric system. The generator and the distributor are close together on the left side of the motor and driven by the same gears that were used for the power tire pump in the first series. This has eliminated the silent chain formerly used for generator drive.

Other features which remain the same are an intake integral with the cylinder block, a stove on the exhaust pipe for preheating the air for the carburetor,

distance in 16 hours and 55 minutes, or at 33.60 miles per hour. The previous record was made in 1913 by A. V. Turner in a large American car. The time was cut two hours and seven minutes.

The high speed for the long distance is more remarkable because there are many railroad gates over the road that have to be opened and shut and herds of stock are also frequently encountered. Razorback mountain has to be crossed. Some very high speed must have been made on the stretches of good going. A larger Vauxhall car also holds the record for the 594 miles from Melbourne to Adelaide, which was made at 40 miles an hour.



Showing the Type of Crankshaft Used in an Eight-Cylinder Motor; Note That the Shaft Is About the Same Length as the One Used in a Four-Cylinder Motor; Two Connecting Rods Are Attached to Each Crank.

with a paste of graphite and oil. This preparation will insure against compression leakage and will also prevent the caps from freezing. Next try the compression by turning the motor over slowly by hand with the ignition turned off. If the valves have been properly ground and adjusted and the compression is found to be strong, it is conclusive that the piston rings are also in perfect condition.

Consider, however, that the valves are known to be properly ground and that the test determined that there was a leakage of compression; it will be necessary to remove the cylinders and examine the piston rings. Before attempting to lift out the cylinders, disconnect all manifold joints, wiring, lever connections, etc. Each cylinder is generally fastened to the crank case by four nuts. Remove the nuts and lock washers and lift the cylinder straight up. Do not crank it. If the car is of the earlier type there is likelihood that the rings have been turned in their grooves and that all the ring slots are in alignment. This condition would afford an open channel for the escape of compression. Turning of rings in the late model cars is impossible because each is held in its position by a small pin in the groove. Leaky rings are easily discovered by the fact that the surface will be a brownish color, caused by the hot gases. The best remedy for leaky rings is to discard them and fit new ones. There are many kinds on the market which have sealed openings and are claimed to be absolutely compression tight.

Piston rings are generally made of cast iron and in the majority of cases will not withstand much stretching. For this reason great care must be taken when fitting them. The lower ring should be put on first. Carefully stretch it so that it just fits over the top of the piston. Guides made of thin sheet metal should be placed over the upper ring grooves so that the ring can be slipped on them to their proper positions. Before fitting rings, clean out the grooves, in which carbon and other foreign matter may be lodged. Next determine that the rings are not too wide for the grooves. This precaution may save considerable labor and time later.

While the cylinders are removed there is a good opportunity to ascertain if the wrist pin is loose in the piston bosses. Also note that the upper connecting rod bearing is securely attached to the pin. Slight play between the wrist pin and the bosses will soon cause a knock which will be difficult to locate when the motor is fully assembled.

Adjusting the Bearings.

The next step concerns the adjustment of the various bearings. The majority of engines are now fitted with plates at the side of the crank case, which may be removed for the purpose of examining these important components. Any play in the camshaft bearings may be easily felt by hand. These

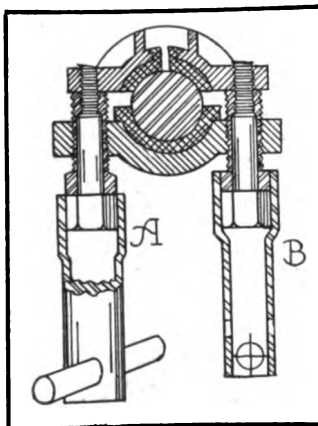
are usually plain bushings and if worn they can be forced out easily and new ones pressed in. With a little study the method used to retain the bushing can easily be discovered. Be sure to secure the new ones in the same manner as were the original bushings.

Any play in the lower bearing of the connecting rod, which fits the crankshaft journal, may also be easily noted by feel. Between the upper and lower parts of the bearing will be found several thin shims, and if any adjustment is necessary it can be made by removing the required number of shims to make the bearing tight. They can be taken out by releasing the retaining bolts and inserting the edge or point of a jack knife. If the rod is of the marine type, an equal number must be taken from each side. Do not adjust the bearing so that it grips tightly on the journal, but just enough to remove all play. As the connecting rods are subject to a greater strain than any part of the motor, it is imperative that the retaining bolts be securely fastened and locked. Too much attention cannot be given to this matter because should the bolts work out, considerable damage will be done to the power plant.

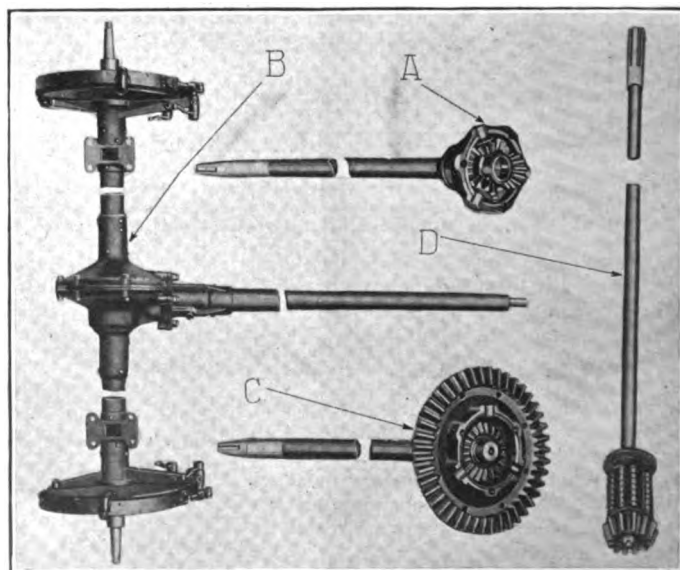
Types of Construction.

Perhaps the simplest method of testing the main bearings is by placing a jack under the flywheel. This releases the weight of the heavy wheel and if there be any play at the forward bearings it can easily be felt by shaking the crankshaft. It is a difficult matter to arbitrarily enumerate the operations necessary to adjust main bearings, as the types used vary greatly in construction. In some instances these bearings are shimmed and can be adjusted after the same manner as the connecting rods. In wide contrast to this is the type of main bearing used in a popular medium priced car. The first operation necessary to adjust the type of main bearing shown in the accompanying illustration is to remove the locking wires from the heads of the locking bolts and with a special socket wrench unlock the two bolts by placing the wrench over the lower bolt, as shown at A, and turning it to the left. The wrench can then be pushed over the head of the threaded spacing sleeve and, by turning, the bearing caps may be brought closer together or moved further apart as the case may require. The method of adjusting the bearing is shown at B.

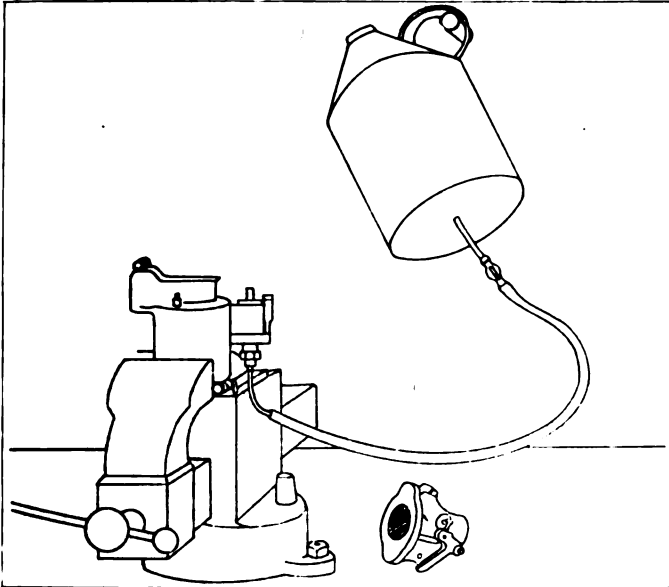
Replacing the cylinders is a task requiring the help of two persons. One should compress the rings while the other drops the cylinders over the pistons. If the operator must do the work unassisted, it is a good plan to make a clamping ring



Manner of Adjusting Main Bearings in Reo Car.



Components of a Semi-Floating Type Rear Axle; B, All Mechanism Is Enclosed in Housing; A, by Removing a Few Bolts It Is Possible to Split the Differential Cage in Two Parts, A and C; the Driving Shaft and Pinion Are Shown at D.



Carburetor Removed from Machine and Given Long Bench Test to Determine the Level and Condition of the Needle Valve.

from very thin sheet metal. This device is clamped around the piston rings and is forced down as the cylinder drops into place. Nearly all cylinders are chamfered at the bottom to facilitate the insertion of the rings. When securing the cylinder to the crank case do not tighten one bolt fully, but pass from bolt to bolt, so that each one has an equal bearing on the casting. If one bolt was fully set before any of the others had been tightened, the tendency would be to cramp the cylinder, thus causing misalignment.

Do not assemble the manifolds until positive that the packing or gaskets between them and the cylinders are in perfect condition. All bolts and nuts which are exposed to heat should have the threads coated with a mixture of oil and graphite so that in the future they can be removed readily.

White lead coated on the edges of the inner surface of the rubber hose which connects the engine with the radiator will insure a water tight joint. Next drain all oil from the crank case, which should be flushed thoroughly with kerosene or gasoline, preferably the former, and filled to the proper height with fresh lubricant. Many motorists obtain good results by mixing a little flake graphite with the oil.

The action of water on metal causes scale to accumulate. For this reason, drain all water from the radiator and engine

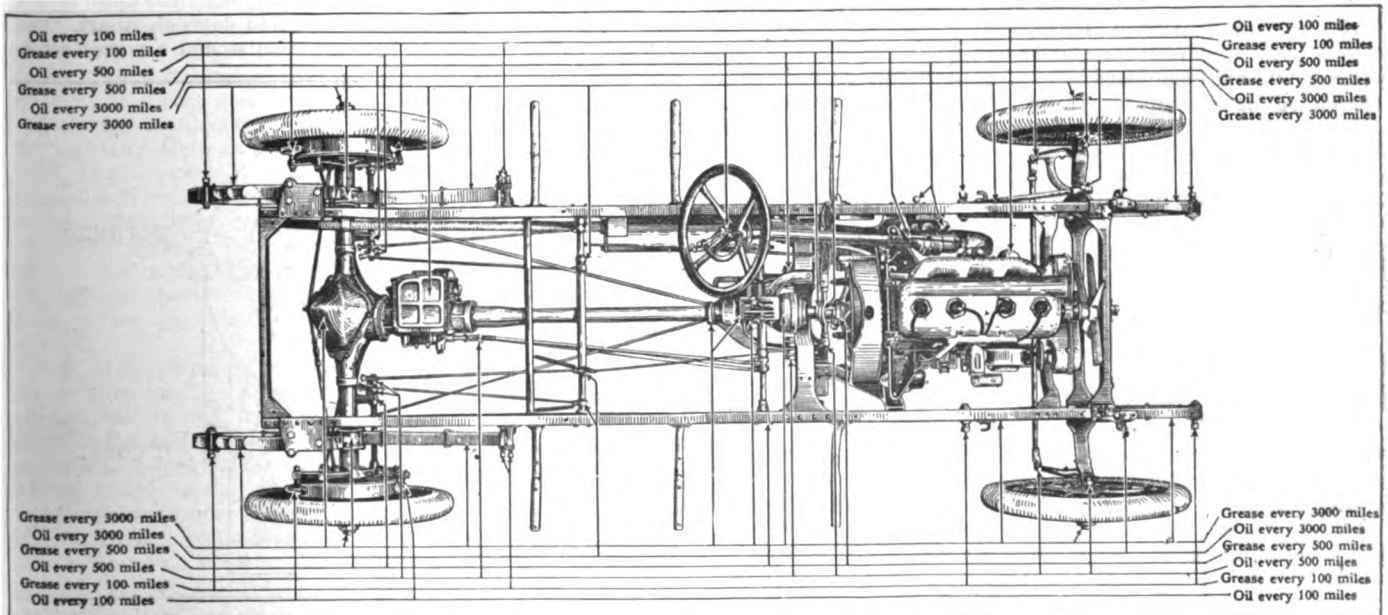
and flush until the water drained from the openings is clear. Next fill the system with a strong soda solution and run the motor for a few minutes. Open the petcocks and drain the solution, after which again flush the system with clear water. This operation will remove any sediment.

The next operation in order is to test the fan belt for looseness. Car designers base the efficiency of the cooling system on a certain volume of air being directed by the fan over the engine. A loose belt will greatly decrease the speed of the fan and, therefore, the cooling of the motor will be impaired. Also examine the fan blades to learn if any are bent. If the car is provided with a positive water circulation, the pump should next be given attention. Examine the propeller blades and driving key for wear. It is good policy to place new material in the packing nut, so as to provide for several adjustments during the season. Shellac both sides of a new gasket and fit it between the cover and the pump case.

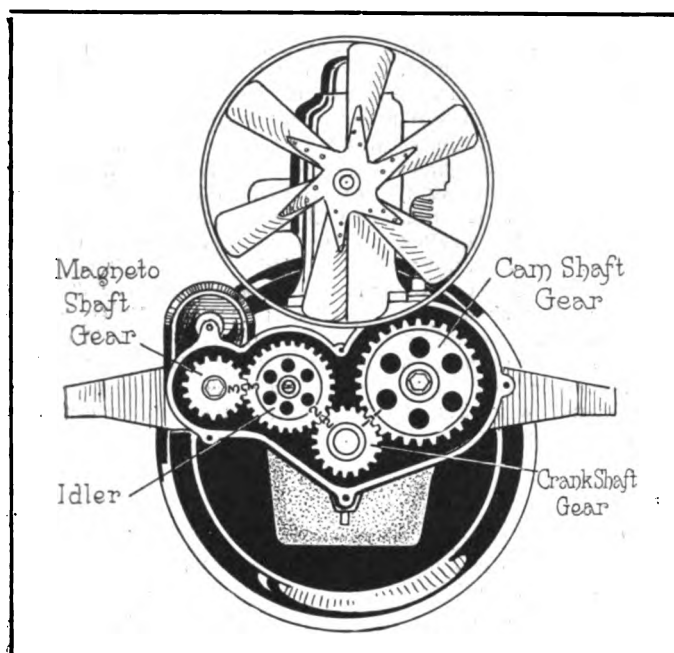
The Carburetor.

The next component to be considered is the carburetor, often termed the heart of the motor. Remove the instrument from the car and subject its several chambers to air pressure. This will force out any foreign matter which might be lodged there. If the float is of the cork type, it should be given a couple of coats of shellac to insure that it will not become gasoline soaked. It is also advisable to test the fuel level while the carburetor is on the bench. This can be done by filling a clean discarded grease pail with gasoline and running a line from it to the carburetor. The fluid should be regulated so that it is just visible at the top mouth of the spray nozzle. The float controls this condition. Its purpose is to firmly seat needle valve to shut off the supply of fuel from the main tank when it has reached the mouth of the nozzle. Continue this test for several hours, as many times there may be a very slight leak which can only be discovered after a long test. If there is leakage, grind the needle valve into its seat with a paste consisting of ground glass and oil. Place new gaskets between the carburetor and the manifold. Before attaching the gasoline line, turn the fuel on at the tank and allow it to flow through the pipe. A steady stream will determine that the line is not clogged.

Regarding the adjustment of the carburetor, it should be remembered that it is correct only when the motor operates smoothly while using the largest volume of air permissible. As the several types of carburetors are adjusted differently, there is no standard rule for the operation. Usually an instruction sheet can be obtained from the manufacturer and by keeping the above principle in mind, satisfactory adjustments can be made. Several of the early types of carburetors were designed to be adjusted by changing the spray of



Oiling Diagram Supplied with Willys-Knight Cars, but Which Will Be Found Applicable to Nearly All Cars.



Timing Gears on Modern Cars Are Marked, as Shown Above, and Insure Perfect Synchronism.

gasoline, but the present tendency is to adjust the instruments by altering the air supply.

The ignition system is apt to cause the motorist the most

concern during the driving season, and so it should now be given careful attention. Remove the spark plugs and disassemble and thoroughly clean them. Examine the porcelains for minute cracks. Though the adjustment of the electrode points vary for the different systems in vogue, usually $1/32$ of an inch space between the two is considered satisfactory. Next inspect all leads for worn insulation or broken strands. Rather than chance makeshift windings, solder every wire terminal and tape.

As a precaution against weak ignition, remove the magneto magnets and test them for strength. When a magnet is efficient a 15-pound steel or iron weight can be raised by it. One end of each magnet is usually marked with the letter N, which indicates the north pole. The other end, which is not usually marked, is, of course, the south pole. When assembling be sure to have all like poles on the same side.

With a fine file or emery cloth, smooth the carbon brushes of the distributor and also the collecting brushes of the armature. If the brushes are much worn or the small springs behind them weak, they should be replaced with new ones. Examine the platinum contact points in the breaker box for looseness, pit marks and the space between when fully separated. Usually the maker supplies a gauge, which is of the proper thickness and should just fit between the two points when they are at the extreme distance apart. If the space is greater or less than this amount, it can be adjusted by the movable contact point.

If a storage battery is used for ignition, lighting or starting purposes, it should test to the full charging point and contain the correct amount of electrolyte. If the battery has not been attended to during the winter, have it charged by some one who is experienced in such work.

TIMING THE VALVES AND THE IGNITION SYSTEM.

Having made certain that the different parts of the power plant are in the best of operative condition, the next consideration relates to the timing. The first operation concerns the valves—it would be useless to attempt to time the ignition without first obtaining their correct working relationship with the pistons. Consider first the effect on the motor if the valves should be opened and closed at wrong intervals. Should the exhaust close too early there would be a quantity of hot burned gas remaining in the cylinder when the intake opens. The result would be that this gas, which should have been forced out of the cylinder, will be driven through the open intake valve and into the carburetor. This would affect the mixture and also cause backfiring at the carburetor and possibly result in a disastrous fire.

Exhaust Valves Late.

On the other hand, if the exhaust valve was to close too late, a weak mixture would be the result, because the intake valve would not commence to open until the piston had partly completed its downward stroke. Back pressure is another condition brought about by the exhaust valve opening too late. The reason for this is that the piston starting on its upward or exhaust stroke, is resisted by the burned gases which cannot escape until the exhaust valve opens.

Practically all automobile motors now in use are of the four-stroke cycle type. By this is meant that four complete strokes of each piston is required before its full quota of power is contributed to propelling the car. These strokes in the order of their occurrence are known as follows: Intake, compression, power and exhaust.

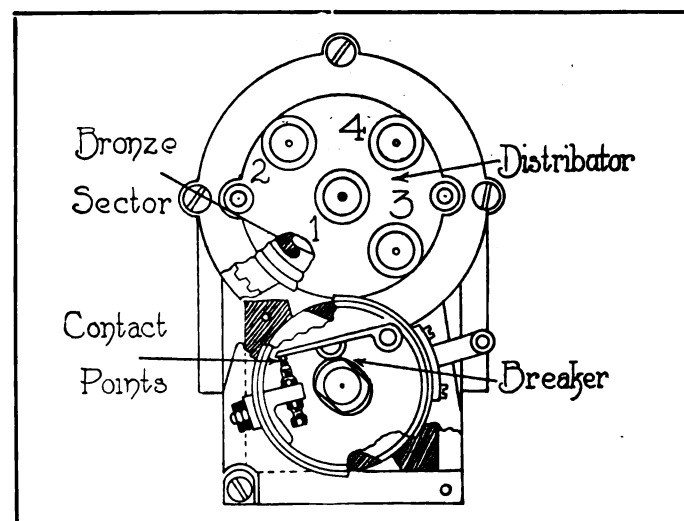
The motorist should not be confused by the great number of cylinders incorporated in some motors, as the number of strokes which each piston must make to deliver one power impulse is always the same in the four-cylinder engine. At the beginning of these strokes the intake valve, if correctly timed, will open to admit gas to the combustion chamber, which is drawn in by the suction created by the downward passage of the piston. At or near the end of the completion of the downward stroke the inlet valve closes and produces a perfectly sealed cylinder. As the piston comes up on the second, the compression stroke, the gas is compressed. At the apex of this stroke, a properly timed spark takes place

in the combustion chamber and ignites the tightly compressed gas. The expansion caused by combustion results in pressure that forces the piston on its downward or power giving stroke.

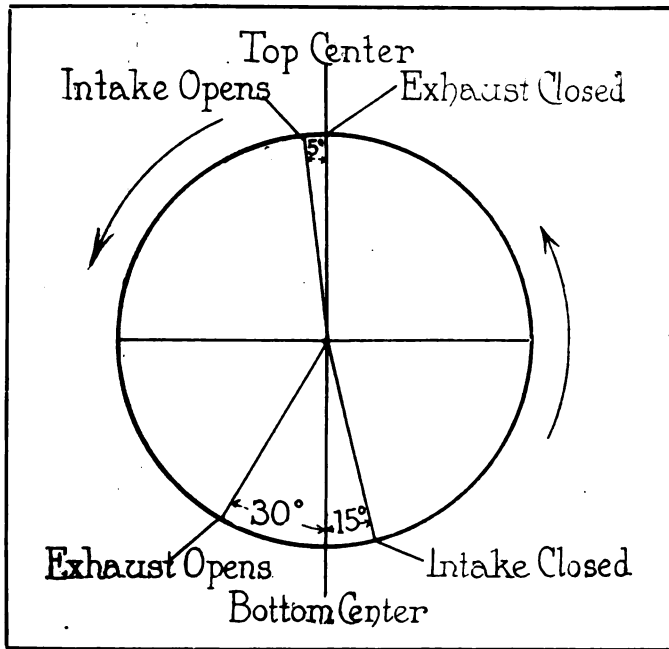
The principle involved is that pressure will always follow the channel affording the least resistance. In the gasoline engine cylinder the piston is the part offering the least resistance and consequently it is forced down. When the piston has reached the lowest point of its travel on the power stroke the exhaust valve, if properly timed, will open so that the burned gases can be expelled into the exhaust manifold on the upward or exhaust stroke.

It is impossible to set an arbitrary rule that will apply to the timing of all motors. The principle, however, does not vary greatly from the following:

In the four-cylinder engine the crankshaft has four cranks, which are set a half revolution, or 180 degrees, apart. Consequently, there must be both an impulse and a power stroke



Position of the Distributor Segment and the Breaker Contact Points in a Correctly Timed Magneto When the Charge in the Cylinder is Ready to Be Fired.



Timing Diagram of a Medium Speed Large Motor.

at each half revolution of the crankshaft. The arrangement of the cranks on this shaft is such that while combustion is taking place in one cylinder the others are compressing, exhausting and taking in a fresh charge of gas. The firing order of the four-cylinder, four-cycle motor is either in 1, 2, 4, 3, or 1, 3, 4, 2 order. The arrangement of the cranks is always such that the pistons in the second and third cylinders are at the top of their strokes when the pistons in the first and fourth cylinders are at the bottom of their strokes and vice versa. Since one set of moving parts weighs exactly the same as the others, it is plain that perfect balance is thus obtained.

Consider now a motor in which the firing order is 1, 2, 4, 3. The piston of No. 1 cylinder is at the top of its stroke ready for firing, while that of No. 2 cylinder is at the bottom and ready to compress the fresh charge of gas. The piston of No. 3 cylinder is also at the bottom of its stroke and ready to expel the burned gases. The piston of No. 4 cylinder is at the height of its stroke and ready to draw in a fresh charge of gas.

Either one or two camshafts may be used in this type of engine. If the motor is of the L head type, all valves are situated on one side and are operated by a single camshaft. If the exhaust valves are on one side of the engine and the intake valves on the other, it is said to be of the T head type and two camshafts are used. Let us consider the motor which has all valves on one side.

Securely attached to the end of the camshaft is a gear which is in direct mesh with another that is attached to the end of the crankshaft. The last mentioned gear has only half as many teeth as the one attached to the end of the camshaft, and because of this fact it is obvious that while the crankshaft revolves once, the camshaft makes but half a revolution. This gear reduction is necessary because each piston must complete four strokes to deliver its impulse to the shaft. It is general practise to form the cams on the shaft and so any change in adjustment of the camshaft with respect to the crankshaft will not only effect one valve, but all of them.

The first operation in valve setting is to record the dead centre lines on the flywheel. On late models this point is marked, but if not, it is not difficult to determine where it should be made. This operation is easily accomplished on any two or four-cylinder engine, as the points on the flywheel will be diametrically opposite.

In a four-cylinder engine dead centre is the highest point reached by the pistons of the first and fourth or second and third cylinders. This can be ascertained by inserting a piece of wire through an opening in the cylinder head until it contacts with the head of the piston. By watching when this wire starts downward with the piston, one can determine when the piston has passed the apex of its stroke. When the

point has been determined the flywheel should be marked indelibly with reference to some point on the motor. The numbers of the pistons which are at top centre should be marked on the flywheel beside each centre mark. This will serve for future reference. Thus if those in the first and fourth cylinders are at top centre, the figures 1 and 4 should be placed over the mark. The figures 2 and 3 should, of course, be placed beside the mark which is directly opposite.

When the timing of a motor is not known it is advisable to write to the manufacturer or dealer. A timing diagram of a large engine not of the high speed type is shown herewith. It will be noted that the intake valve opens at five degrees past top centre and closes at 15 degrees past bottom centre. On the next revolution of the crankshaft the exhaust opens at 30 degrees before bottom centre and closes at top dead centre.

To show that timing of motors varies according to design, the other diagram herewith illustrates the proper valve timing of a well known car. The intake valve starts to open at five degrees past the dead centre line and closes at 30 degrees past the opposite dead centre line. The first two strokes of the piston represent the suction and compression strokes respectively. The next in sequence is the power stroke, and the fourth, or the last half of the second complete revolution of the flywheel, the exhaust stroke. In this motor the exhaust valve starts to open at a point about 14 degrees past the dead centre line and closes on dead centre.

It is imperative that the timing adopted by the manufacturer be followed and if the indicating marks are not already on the flywheel, it is a simple matter to make them.

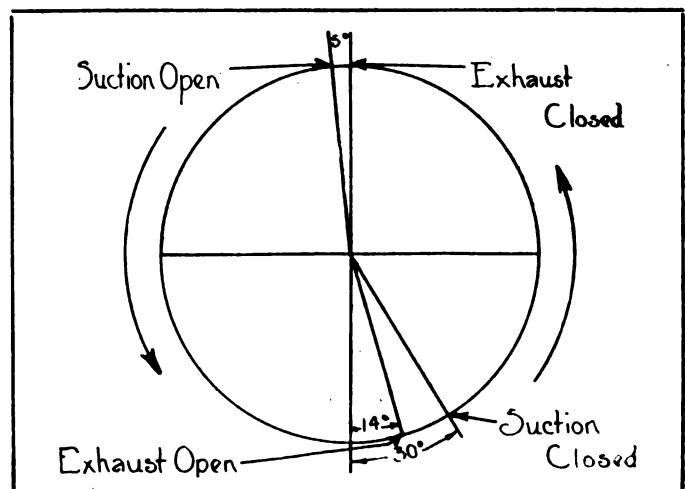
To determine whether a valve is or is not fully closed, the operator should attempt to pass a thin piece of paper between the stem and the push rod. If the paper can be inserted the valve is fully closed.

Meshing Points Marked.

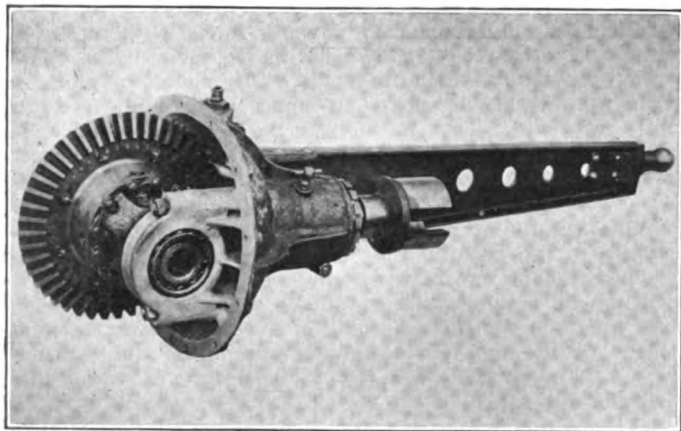
The manufacturer generally marks the meshing point of the camshaft and crankshaft gears after the motor has been assembled and the correct timing obtained. For example, two teeth on the crankshaft gear may be centre punched at the side, as would be one tooth on the camshaft gear. By meshing the gears so that the marked tooth on the camshaft gear sets between the two on the crankshaft gear, the proper relationship is obtained.

Let us now consider the extreme case where the timing gears have been disengaged and when reassembling it is found that they are not marked. It will first be necessary for the operator to make a rough estimate as to the number of teeth the camshaft gear must be turned so that the proper timing might be reached. Having done this and then meshed the gears, mark the meshing points with a piece of chalk. Test the timing and if it is found to differ from that established by the manufacturer, remove the crankshaft gear, but be careful not to shift the position of the crankshaft.

The next operation is to rotate the camshaft gear one tooth or more at a time, as the case may necessitate, in the



Timing Diagram of a Well-Known Motor Which Differs Greatly from the One Shown Above.



Differential and Pinion Support for Full Floating Rear Axle, Showing Rigid Manner in Which These Gears Are Kept in Alignment, Regardless of Any Possible Bending or Twisting of the Rear Axle Housing.

proper direction. Replace the crankshaft gear and retest the timing. This is tedious work and often tries the work man's patience. It is imperative, however, that this process be followed until the relationship of these gears is exactly as the manufacturer intended. If a valve opens too early it will close too early; if it opens too late, it will close too late. In both cases it will indicate that the proper relationship between the camshaft and crankshaft gears does not exist.

When it is found that the timing of the valves is irregular, that is, most of the valves open and close on time, while others are late or early, the remedy cannot be effected by adjustment of the gears, but must be made by adjusting the individual push rods. These are usually adjustable. Consider that all the valves appear to be properly timed, except one, which opens too early and closes too late. The remedy for this is to shorten the push rod. The result is obvious. The rod will engage the valve stem later and when descending will release it sooner.

Timing the ignition does not merely refer to obtaining a naked spark in the cylinder when there is a fully compressed charge of gas stored there. In its broadest sense the term means the firing and expansion of the charge. Although slight, there is a difference between the time at which the electric spark takes place in the cylinder and the time at which the gas fully expands. There is also a slight interval between the breaking of the primary current and the producing of the secondary, or current of high potential. This slight interval is often referred to as the lag.

Offsetting the Lag.

To offset this lag at different engine speeds, it is imperative that the commutator or timer be advanced proportionally. This is essential regardless of whether a battery or magneto system is employed. This is the reason why the spark lever is usually placed on the steering column, where the driver can operate it as he finds necessary. These slight intervals vary according to the engine speed and only by experience can the driver determine how to operate the lever so that the proper advance may be made for the different engine speeds. The operation will also depend largely upon the design of the motor, amount of compression, condition of coil, etc.

There are several methods of timing the ignition, but the simplest is to turn the engine over by hand until the piston of No. 1 cylinder reaches its highest point of travel on its compression stroke. Continue to turn until the piece of wire which has been inserted through an opening in the head of the cylinder descends for about a half inch. With the spark lever fully retarded, a spark should occur at the plug at that point of piston travel.

Although it is always said that the spark should take place at the height of the compression stroke, this is poor practise, because it would endanger the safety of the operator when cranking the motor by hand. It is obvious that when starting the motor by hand crank the flywheel at the end of the crankshaft has not developed sufficient momentum to prevent the piston being driven in a reverse direction should the spark take place a little early. Therefore, for

the sake of safety, the spark is timed to take place a trifle after dead centre.

Consider first the ordinary battery type of ignition. If the spark does not appear at the plug in the cylinder when the piston is at the top, the commutator roll should be loosened and moved forward until its just registers with the contact point in the commutator shell provided for that cylinder. If the roll is keyed to the shaft it will be impossible to move it in the manner just described. In that case the advance rod can be lengthened, which will force ahead the contact point in the commutator shell. The result, however, is the same.

In some cases it will be necessary to shorten instead of lengthen the rod. This can be determined by the direction in which the advance is made. As the contact points are properly spaced in the commutator shell and cannot possibly be moved, it is only necessary to time the ignition for one cylinder. The remainder will be regulated automatically.

Timing the Magneto.

To time the magneto, assuming that it has not been disassembled, but merely removed from the car and cleaned, disconnect the driving point and turn the armature shaft until the bronze sector in the distributor is beginning to register with the contact point that supplies the current to the cylinder being timed. The direct connection to the engine should then be made with the points in this described position. If the magneto drive shaft has been removed from the car, it may be necessary to remesh the gear at the end of the shaft so that a proper connection to the magneto can be made. As in the case of the battery ignition, it is only necessary to time the ignition for one cylinder to produce the correct timing for all cylinders.

If the clutch is combined with the gear set, as in the planetary type power transmission, it will need little if any attention, unless badly worn. If the bands of the low and reverse speeds are so worn that adjustment is impossible, it will be necessary to reline them. A commonly used type of multiple disc high speed clutch is operated by small bell cranks, which are carried by a spider and are pressed against the disc by a small sliding cone, which is used to expand these fingers or cranks for that purpose. Adjustment is made by loosening the retaining nuts on the spider and screwing the latter nearer to the discs.

With sliding gear transmissions, two types of clutches are used extensively. One of these, the multiple disc type, consists of a number of plates which are driven by the flywheel or engine shaft and a corresponding set attached to a driven member, which is connected with the gear set. The plates are arranged so that when they are pressed together they afford friction drive through a direct connection with the engine. This type of clutch will no doubt require cleaning, which can be done by filling the case enclosure with kerosene and then engaging and disengaging the clutch several times. If the clutch is designed to operate in oil, a me-



Car Owner Determining the Alignment of Front Wheels—If the Distances Are Not About the Same, Lengthen or Shorten the Tie Rod as the Case May Require.

dium cylinder grade should be used after the kerosene has been removed. If the plates do not at first readily grip when the clutch is engaged, adjustment may be made by screwing up on the nut behind the heavy coil spring, thus increasing its tension. If after making this adjustment the trouble is not overcome, the clutch should be removed from the car, disassembled and examined. Frequently one set of plates carries a lining. If this material is worn, new lining should be used.

The leather facing of the male member of the cone type of clutch should be examined and if worn beyond adjustment a new band should be fitted. Apply several coats of neatsfoot or castor oil to the new leather to make it soft and pliable. If the clutch has a tendency to slip when engaged, adjustment can be made by increasing the tension of the spring, or springs, behind the male member.

Remove all lubricant from the gear set case and thoroughly wash the case and gears with kerosene or gasoline. Drain off the fluid and examine the different parts. Examine the gear shafts for end play and if there is any, some type of adjustment will be found at the ends. Also determine that the full surface of the gears on the countershaft mesh with the gears on the main shaft. Some cars have long rods connecting the gear shifter with the controlling lever. This construction necessitates the using of two or more pins, which are apt to wear, in which case satisfactory operation could not be obtained. Replace the pins if worn.

The universal joints may cause trouble if neglected at this time. Force back the cover of the joint, remove the old lubricant and bathe the parts in kerosene. Tighten and lock the retaining bolts, after which the joint can be packed with new lubricant. The drive shaft and rear assembly may need no other attention than cleaning and packing with new lubricant. It is advisable, however, to test the adjustment between the differential ring gear and the driving pinion. The adjustment requires skill and care and is usually considered beyond the ability of the average motorist. Nevertheless, if one wishes to attempt it, the operation is as follows: Remove the housing cover so as to expose the differential and then jack up one or both rear wheels. Except on the very highest priced cars there is generally a high point of contact between the two gears, and so the wheel should be turned until this point is determined. The close adjustment must be made at this point. On the majority of cars there are two adjusting collars, one on either side of the differential cage, and these may be loosened and turned either way as the condition may require. Be sure to lock the collars after making the adjustment.

Take Out Bearings.

The next operation in order is to remove the rear wheels and take out the bearings and felt washers which are designed to prevent the grease from working out. Through long service the washers are apt to become hard, or even worn. Place them in a kerosene bath so as to remove the grease. Also clean the bearings with kerosene, using a brush to insure that all parts are reached. Pack the bearings well with grease before replacing in the housing. While the rear wheels are off the brake linings should be examined. If worn they can be replaced at very little cost. Replace the wheels and then test the brake action. This is an operation requiring the services of two persons. While one person gradually applies the brake from the driver's seat the other should attempt to turn the rear wheels, noting that the pressure on each is equal. Adjust the brake so that one wheel does not lock before the other. Both brakes should be tested in the same manner.

The next step is to remove the front wheels and clean the bearings with kerosene. After the wheels have been replaced, test them for looseness, which is done by grasping a wheel with one hand at the top and another at the bottom and alternately working it toward and away from the body. If it is loose, it can be tightened by screwing in the retaining nut behind the front bearing. Do not adjust too tightly, but just enough so that the play is overcome and that the wheel can be revolved easily. If after making this adjustment, the wheel is still loose, it is proof that the axle bushings, which hold the steering spindle bolts, are worn out.

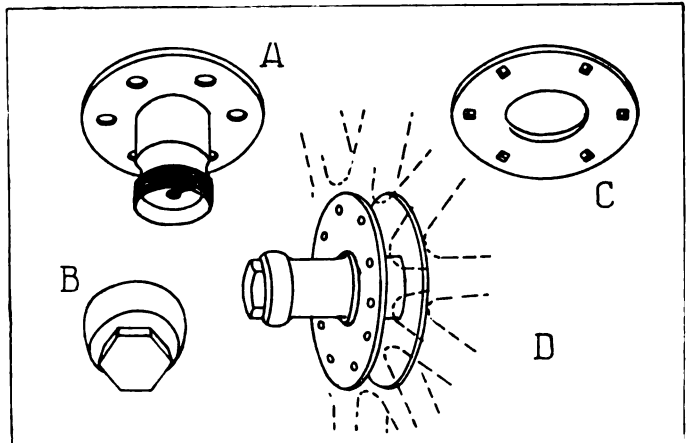
They should be replaced by new bushings.

To facilitate steering and to prevent excessive tire wear, it is imperative that the front wheels be in true alignment. Besides accidents, the striking of large stones, deep ruts and contact with the side of the curb are apt to be the cause of these being out of true. There are several methods of obtaining alignment, but one which is both simple and accurate is as follows: On the inside of the wheel and at an equal distance from the ground and as near the centre line of the wheel as possible, scribe a line on the felloe. This line ordinarily should be on the dead centre line, but generally the frame and the dust pan prevent the extending of a gauge at this point and so the marks have to be placed a trifle lower. Mark the inner side of both wheels in the same manner. The alignment is reached when the distance between both front marks is approximately the same as the distance between the two rear marks.

Adjustment is made by shortening or lengthening the tie rod which connects the two steering knuckles, as the case may require. Shortening the tie rod draws in the rear of the wheels and forces out the front, while lengthening the rod lessens the distance between the front of the wheels and increases the distance at the rear.

Lubricate Spring Leaves,

Spring squeaks are very annoying. They can easily be prevented or eliminated by being lubricated regularly and properly. With a leaf separator or screw driver pry apart the spring leaves. Scrape away all rust formation and on



Rear Hub Construction; A, Hub Shell; B, Hub Cap; C, Movable Flange, Showing Parts Assembled.

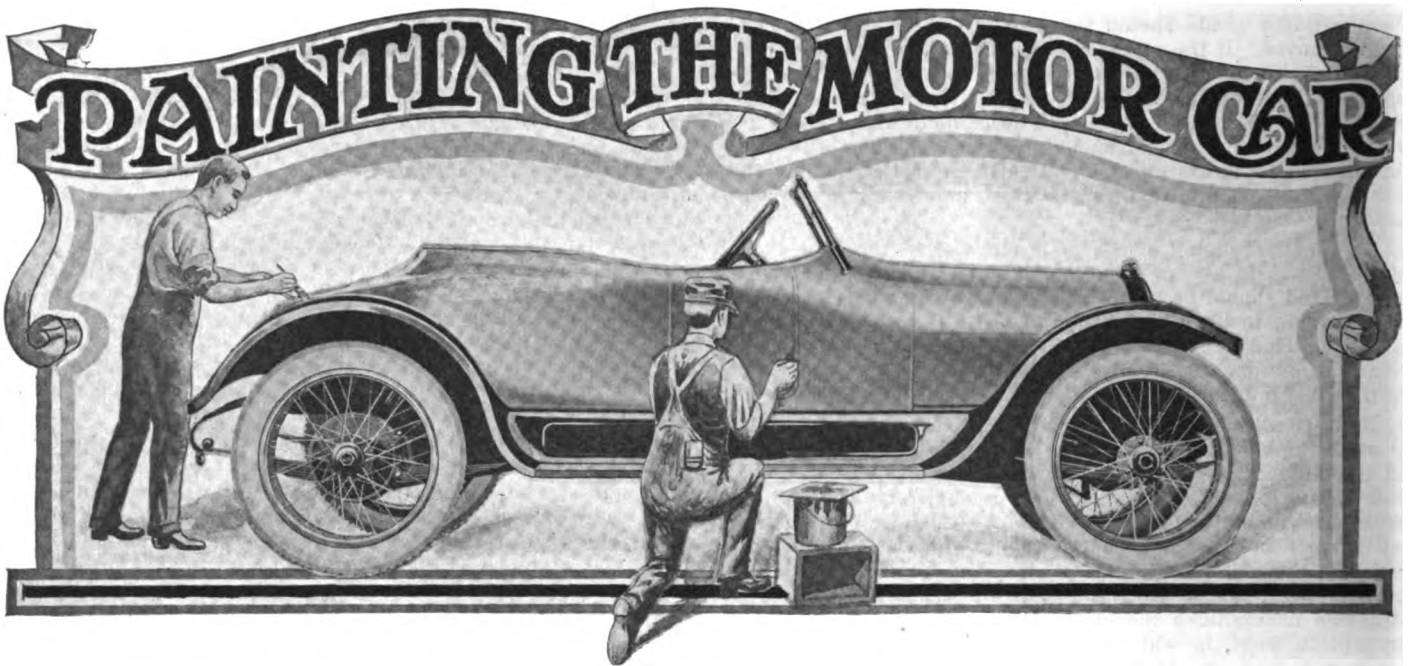
each leaf lay a quantity of flake graphite, which can be spread for the full length with a feather. The effect on resiliency will be surprising.

Next examine the spring hangers and the bushings in the car frame and ends of the springs. If the bushings are worn, replace them. Do not forget about lubrication when replacing the hangers.

The torsion, radius and torque members must be given attention to make sure that they are in correct relationship. If the rear assembly is supported by truss rods, test these for looseness. They should be set up snug, but not too tightly, else they are apt to alter the alignment of the differential components.

There are two types of steering gears in general use, reversible and irreversible. As the adjustment of these vary greatly, precise instructions cannot be given, but as provision for adjusting is always made, the correct method can be determined by a little study. Examine the steering wheel to determine that the key has not become worn or loose. Usually adjustment is provided for taking up any play in the ball and socket joints of the drag link, the general method being to screw in the ends of the sockets.

The last operation is to again inspect the parts to determine that all parts are properly adjusted and that washers, nuts, bolts and cotter pins have been replaced. Next apply oil to every moving part of the car. Whenever there are moving parts, friction exists, the only remedy for which is lubrication.



THE average motorist is very careful of his personal appearance and the appearance of his home and still will use his motor car from season to season without giving any particular thought or care to its finish. As long as the working parts are operating satisfactorily he seems to be content to ride in a car that, to say the least, is slovenly. And he does this notwithstanding that it is human nature to gauge a motorist's social standing and his character by the general appearance of his car.

This stricture does not apply to all motor car owners, of course, but it does fit the cases of a large majority, as anyone can discover by observing the machines that pass on any well travelled boulevard or highway. It is a constant offense to the aesthetic senses to see a carefully dressed motoring party gaily riding along in a car whose finish is scratched and blistered and partially concealed under a coating of dirt. It is an incongruity, to say the least. Civic organizations have of late adopted the practise of inaugurating "clean up" days, and possibly some such plan could be worked out to the benefit of motordom.

Another source of offense is a crudely finished car, it giving evidence that the owner has ambitiously attempted to paint the car himself. It is not impossible for almost any capable owner to do this kind of work, though almost invariably the re-

sult will be exceedingly amateurish. Unless one has had practical experience in doing such work, it is best to delegate the task to a professional automobile painter. As a consequence the owner will not only have the car returned to him with a sleek and uniform finish, but the finish will endure far longer than if he had done the work himself. With proper care on the part of the user a well executed job of this kind should afford satisfactory service for four or five years.

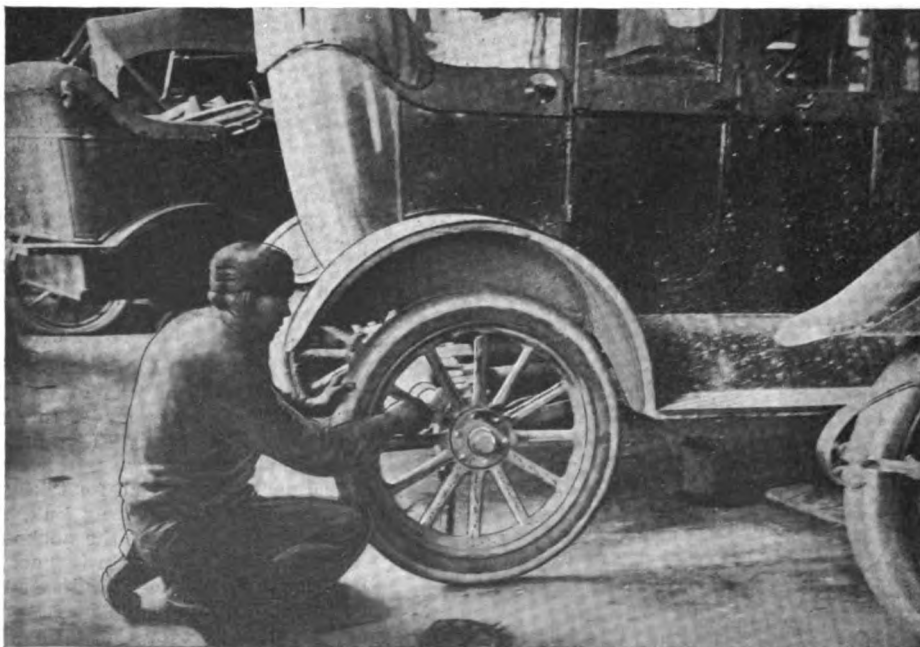
Painting is a Trade.

Automobile painting is a highly specialized trade and each job requires a length of time which to the uninitiated appears to be unnecessary. Because of this lack of understanding the painters are beset with an evil that if persisted in precludes the possibility of turning out good work. That evil is the demand for quick

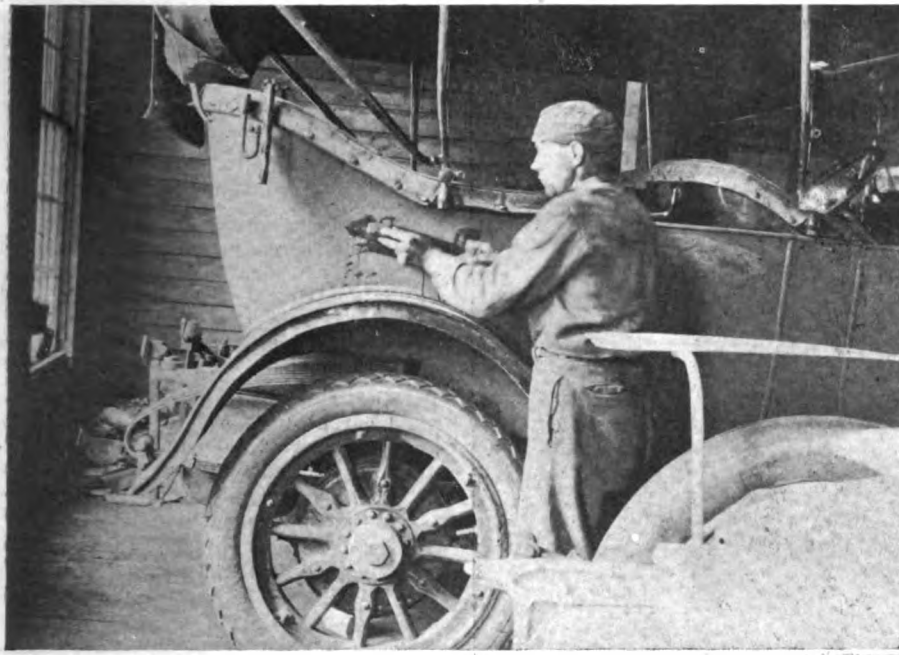
work. An owner or his driver will bring in a car and insist that it be ready for service within a week or 10 days. Good work cannot be done so quickly, as will be shown in the following description of the operations that must be done. Some painters, under the urgings of impatient customers, will attempt to rush the work, with the result that the desired quality of work has not been obtained. The fault lies chiefly with the owner. He should have exercised sufficient forethought to have the work done during the season in which his car was not being used and when he could have spared all the time necessary.

The average motorist has little conception of the number of operations and the time required to produce a good painting job. One often reads that a car has received from 16 to 20, or even more, coats of finish before leaving the factory. In the majority of cases the reader

is skeptical of this statement, he being apt to believe that it is impossible to place 20 coats of paint on the machine and therefore usually dismisses the subject as being merely part of the selling talk. If one was to spend a day in a paint shop he would readily understand the meaning of this statement. The car does not actually receive 20 coats of paint. In the majority of cases between 12 and 14 of these coats consist of applications of materials that will enable production of a nice finish.



The First Process Through Which a Car Must Pass Is Cleaning—Illustration Shows Work Man Sandpapering Wheel.



After the Desired Number of Coats of Rough Stuff Have Been Applied the Body Is Rubbed with Pumice Stone to Produce a Hard, Smooth Surface.

In not all cases does the machine receive a total of 20 coats, but this is a matter on which the painter must use judgment and depends wholly on the original condition of the work. From 12 to 14 coats is about the minimum which the car receives in the paint shop. A summary of the operations which a car must pass through before it is finished is as follows: Cleaning, scraping, primer, rough stuff, guide coat, color, color varnish, rubbing varnish and finishing varnish. Another factor which helps to decide the number of coats that a car requires is that certain colors require more coats than others. To produce a high-grade job the best finish is only obtained by numerous applications of rough stuff.

Methods Differ.

As can be expected in every trade, practise differs greatly in different shops, but the illustrations and data contained in this article, which were obtained from the Boothman Company's paint shop, Providence, R. I., will be found typical. The information given concerns the average car and is in no manner applicable to extreme cases.

When a car is brought to the shop, the first process through which it must pass is that of cleaning. Dirt is removed by scraping and brushing, while grease and oil are removed with gasoline. The top is raised and given a thorough brushing, both inside and out, after which it is removed from the car.

The next operation is that of removing the old paint. The agent used for this purpose depends upon the material used to form the body. If the body is of metal several coats of remover are applied, after which the paint is scraped off. When the body is composed of wood it is not advisable to use paint remover, because this fluid has a tendency to penetrate into it. Gasoline will neutralize the action on the surface, but will not neutralize the action of the fluid which has sunk in. Soon after applica-

tion the paint remover will work back to the surface of the wood and will damage even the finest work. For this reason, the Boothman Company's work men always remove the old paint from wooden bodies by the blow torch method.

Another obstacle which painters have to overcome is that the car owner usually places a limit on the price which he will pay for the work. This is unreasonable if enduring work is desired. If a thorough job is to be done, the body must be removed from the chassis so that all parts will be accessible and can be accorded the greatest care possible. In the majority of cases, however, the body is allowed to remain on the car, the fenders, lamps and trimmings being taken off.

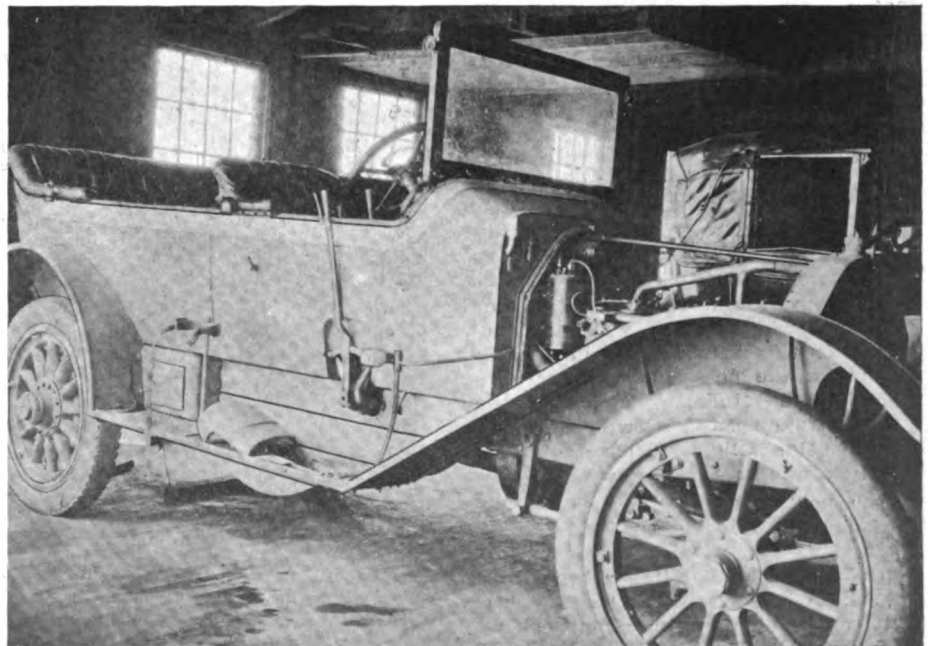
After the bare metal body has been

thoroughly sand papered and brushed clean, it is then ready for the primer. The number of coats of primer applied depends wholly on the condition of the metal. In some instances one will be sufficient, while on the other hand it may be necessary to use two or more. Primer is an agent which firmly grips the body metal and affords the painter a tough, elastic ground for applying the other coats that follow. Two days should ordinarily be allowed for the priming coat to dry; 24 hours is considered to be the minimum. While the primer is drying it is a good time to putty cracks, crevices or other uneven places. The body is then lightly rubbed with sand paper so as to produce an even effect. After the first coat of primer has been allowed to thoroughly dry, a second coat is applied when necessary.

Purpose of Rough Stuff.

When the second coat of primer has been allowed to dry for at least 24 hours, the next process is the applying of the rough stuff, or surfacer as it is generally termed. Ordinarily a metal body is given at least six coats of rough stuff. This is the minimum; often a greater number is required. The purpose of the rough stuff is to afford a firm, hard, level surface before applying the color. Twenty-four hours should elapse between applications of each coat of rough stuff. When the owner insists that the car be completed in the shortest time possible, two coats are put on in a day. The first coat is applied in the morning and the second just before closing time at night. The first is usually put on the lengthwise of the panel and the second brushed across. All following coats are similarly applied.

When the painter has decided that the car has received enough coats of rough stuff, the work is now ready for the guide coat, which is so termed because it is rubbed off in the smoothing process; its only purpose is to act as a guide



Car to Which Color Has Been Applied Being Allowed to Dry Before Applying the Color Varnish.



Showing Painter Surfacing Rubbing Varnish and Using a Wet Piece of Felt on Which Is Sprinkled Powdered Pumice Stone.

for the work man when rubbing. Any color may be used for this coat and it is very thin in consistency. When the guide coat has been scoured or rubbed off, showing the uniform darker color of the rough stuff, the work has been properly surfaced. The experienced painter, however, is not wholly guided by this condition, he often exercising judgment which he has developed through long practise.

Rubbing Rough Stuff.

The rubbing operation is done either with a pumice stone or a German rubbing brick. The body's surface is well wetted with soft water and the rubbing is done with a positive straight arm movement. It is essential that the surface be kept well moistened so that the stone will not gum up or scratch the surface.

The body is then dusted and thoroughly washed to remove any dirt or foreign matter. Although several coats of rough stuff may have been applied, much of it has been rubbed off when smoothing the surface. To obtain the best results the car should now be allowed to stand for 24 hours, but usually it is allowed but 12 hours. The work man then inspects the surface and if there are any rough spots he reduces them with sand paper.

The body is now ready for the color, the number of coats of which depends mostly on the shade of color desired. In the majority of cases two or three applications are sufficient, 24 hours being allowed to elapse between each. Each coat of color is lightly rubbed with sand paper so as to retain the smooth effect.

The next work is the applying and surfacing of the color varnish. Formerly plain finishing varnish was placed on top of the color, but it has been determined, so it is stated, that a better effect can be obtained by adding color to the varnish. This is the point where the painter must display much skill. Color varnish should be allowed to dry

for at least 48 hours and then a second coat applied if necessary.

Rubbing varnish is next applied. Though painters seem to have different opinions as to the exact number of coats required, it is safe to say that at least two should be considered as the minimum. For high grade work 48 hours should be allowed between each coat, although many times the wait is but 24 hours.

As stated above, surfacing varnish is an art. The first step is to thoroughly wet the body and then rub with a felt pad which has been dipped in water and then into powdered pumice stone. At first the pressure should be slight and then gradually increased until the desired effect is obtained. The rubbing is always done in one direction and lengthwise of the panel. Each coat of rub-

bing varnish is applied in this way.

The body is now ready to be striped and the borders of the panels colored to any desired tint. This work requires patience and a steady hand. A good painter can make a stripe as thin as a lead pencil mark.

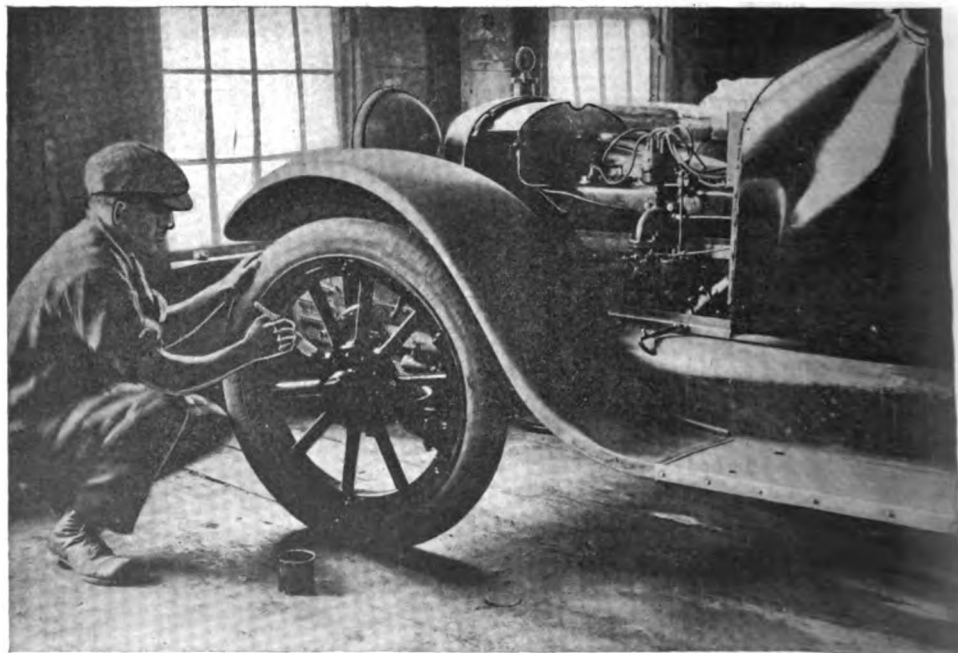
Finishing Coat.

After being allowed to dry for 24 hours the body is ready for the finishing coat. This is of a hard drying varnish and after applying it the body should not be removed from the shop for at least a week. As this is the finishing coat, no rubbing is done.

Mud guards, lamps, steering column and car fittings as a rule are not painted, but are enameled. Generally two coats are sufficient, but like the body, the number required depends upon the condition of the parts.

The painting of the chassis is not nearly as difficult as the painting of the body. Unless flaky, the old paint is seldom removed. After thoroughly sand papering and dusting the parts, a lead coat is generally applied and allowed to dry for 24 hours. After this three coats of color usually follow, allowing at least 24 hours between each. The parts are then striped, after which the rubbing varnish is applied and allowed to stand for 48 hours. The varnish is then rubbed in, in the same manner as on the body, after which the finishing varnish is applied and the work is completed.

Though the car should not be removed from the room for at least a week after the finishing varnish has been applied to the body if the best results are to be obtained, in a majority of cases it remains but two days. The car owner is too eager to regain the use of his car to heed the advise of the painter and to him the varnish appears thoroughly set. As a matter of fact the surface may be firm, but inasmuch as varnish commences to harden from the outside, the varnish underneath is certain to be soft and easily damaged. A high grade var-



Painter Applying Finishing Varnish to Wheels—Usually This Is the Last Operation.

nish is very elastic and requires a long time before becoming thoroughly set. In many instances it does not become altogether firm throughout for nearly four or five months.

Some painters attempt to hasten the drying action by spraying cold water over the surface. This procedure will temporarily harden the outside surface, but when exposed to the hot sun it will soon soften again and is apt to blister. Blistering is also due to applying the varnish before the under coats are thoroughly dry. The old adage "haste makes waste" is especially applicable to motor car painting.

With these facts in mind it is hoped that motorists will be more considerate in their demands upon the automobile painter. By allowing him plenty of time, the car owner will receive high quality work, which will endure as long as he is likely to own the machine. Furthermore, when the time comes for disposal of the car, either by sale or by turning into the dealer on exchange, he will find that a well applied and a well taken care of finish will greatly enhance the value of the car in the eyes of the purchaser.

NEW EIGHT FROM PITTSBURG.

The Murray Motor Car Company has been organized in Pittsburg, Penn., to produce a car of eight-cylinder design, seven-passenger capacity and 127-inch wheelbase. The former Packard distributor in Pittsburg, W. B. Murray, is president of the company and with him are J. W. Pontefract and W. W. Bensei. Fred Berger is chief engineer and Joseph Gardham production manager. The car will use the Herschell-Spillman motor, Covert gear set, Timken axles, Perfection springs, Parish & Bingham frame, Gemmer steering gear and Blood universals. Westinghouse starting and lighting equipment and Bosch ignition will be standard.

A. L. A. Warns About Car Registrations.

Legal Association Offers Valuable Advice to Owners of Cars.

Warning is given to motor car owners by the Automobile Legal Association that if they wish to retain their ordinary rights at law they must be very careful that their car registrations are in every way legal, otherwise they will be adjudged by the courts as trespassers on the highway and can recover no damages if anything happens to them.

This is true of cars that are operated in a state in which they are not registered for longer than the 10 or 15-day limit that is allowed for visitors. Two cases of this sort, in which one was hit by a train and another by a trolley, were decided against the car owners, who might otherwise have been entitled to damages on the ground that the cars were not legally registered and that they had no rights on the road.

It is true of cars in which any misrepresentation has been made in securing registration or that are operated on the old registration after the date on which the new is required. It has been held true in the case of a car which was owned by a man, but was registered in his wife's name. The Massachusetts legislature has passed a law which exempts guests in the car from the rule providing they can show that they had no knowledge that the car had not been properly registered.

BOSTON TRAFFIC CRUSADE.

Boston traffic policemen have been ordered to take energetic steps to stop the violation of traffic ordinances, especially one which requires that no motor cars be left standing on the streets more than 20 minutes except between 6 p. m. and 6 a. m. They have been instructed

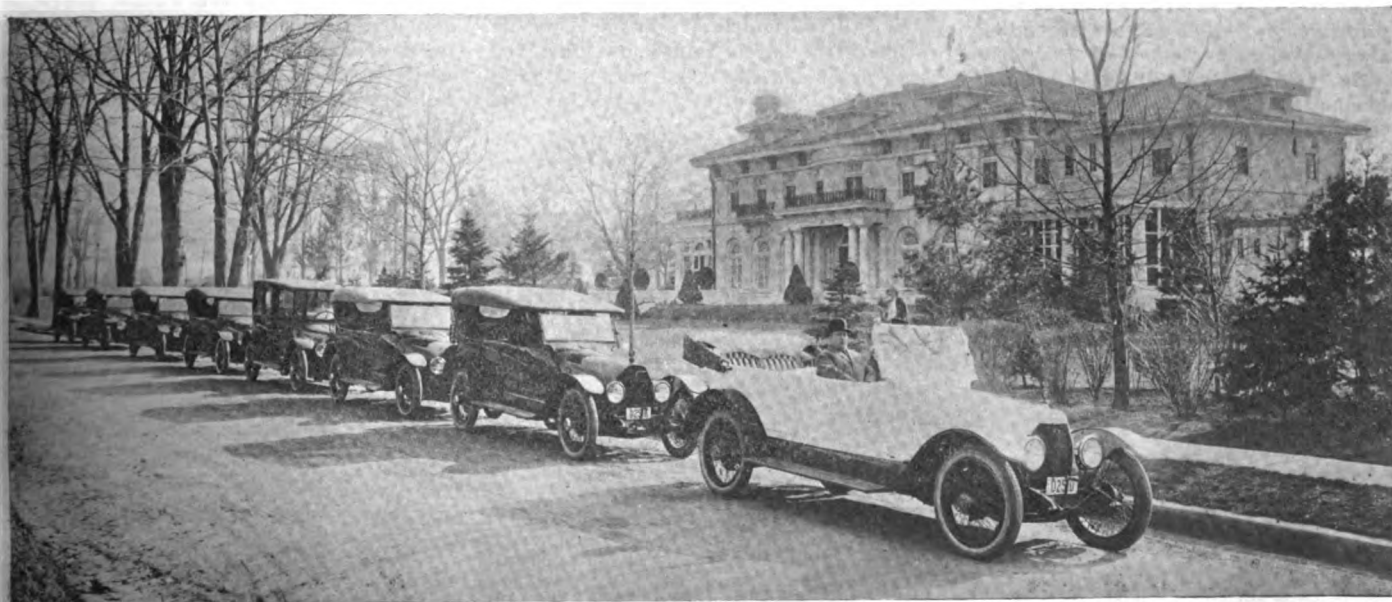
to drive such cars to a garage and then to return the storage check to the station house. To obtain his car the owner must pay for the storage and then answer a summons for breaking the ordinance. Similar treatment will be given owners who stop at the left side of the curb or who leave their cars for more than five minutes on some of the more congested streets.

FIGHT NEW YORK LEGISLATION.

New York trade interests are fighting to prevent the signature by the governor of two bills designed to effect motoring. One of these is the Cromwell Kelley bill, which makes it necessary for every car owner who drives his own car to get a chauffeur's license. This puts it in the power of the police to prevent a car owner from driving his own car. The bill was supported by the New York City police department. The other is the Hewitt bill, which establishes a commission to investigate the abuse of highways by motor trucks.

COLLINS OPPOSES TIME PLAN.

That the spread of the installment plan method of selling automobiles would be a distinct step backward is the opinion of R. H. Collins, general sales manager of the Buick company. The plan is fundamentally wrong regardless of the article sold, in his opinion. The automobile industry started on a cash payment basis and was the first big industry to start in that way and much of its rapid progress has been due to that fact, said Mr. Collins. It has had plenty of floating capital with which to build large plant extensions and has not been embarrassed by slow collections. It will be a great injustice to the men who buy cars on the installment plan, in many cases, as many of them will over-estimate their resources and find it very difficult to keep up their payments.

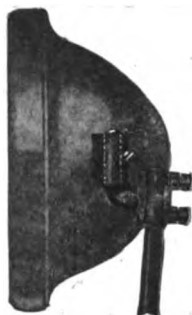


A Fleet of Owen Magnetic Cars Just Before the Start of the Run from Pelham Manor, N. Y., to Boston—The Cars Represent One Day's Delivery to M. F. Chase, the Boston Agent, and a Total Value of \$36,000—In the Background is the Home of R. M. Owen, After Whom the Cars Are Named and Who is Active in the Production of the Baker R & L Company.

PRACTICAL ACCESSORIES AND EQUIPMENT.

HEADLIGHT ADJUSTERS.

Traffic authorities in several states have adopted regulations compelling motorists to eliminate the glare from the



headlights. One of the best methods for accomplishing this end, without forfeiting any of the light volume, is to tilt the lamps slightly downward. This may be done by bending the props, but a much easier and more workmanlike method is achieved by using the C-S headlight adjusters, one of which is shown herewith. An accurate adjustment can be made quickly by anyone and with a small wrench.

A set of C-S headlight adjusters consists of four adjustable auxiliary supports, mounted one between each lamp lug and the prop, and they can be used on any lamp that is mounted on a forked prop. Two styles are made. Type A is designed for lamps that have set screws in the lugs and type B for lamps which are held in position with a cap nut.

Manufactured by the Culver-Stearns Manufacturing Company, Worcester, Mass. List price, \$2 per set.

A-W CONVERTIBLE TOP.

Illustrated herewith is an all-weather convertible top, which affords all the advantages and conveniences of a one-man touring type and the full glass enclosed limousine. The top is somewhat of a departure from other convertible designs

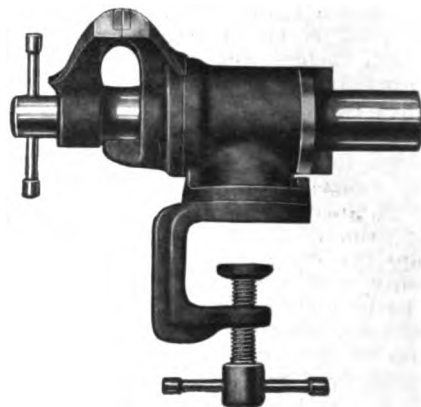
in that it affords the motorist of moderate means with a construction which is adapted to spring, summer, fall and winter service and without the expense of maintaining two distinct types of bodies. It is of light construction, increasing the weight of the car only about 30 pounds, thus allowing its use without altering or strengthening any of the car parts.

One of the distinctive features is that when the glass panels are removed the top cannot be distinguished from the conventional one-man type. In fair weather the panels can be taken out and the top lowered, affording the use of an open body. With the top raised the glass panels can be attached or removed in two minutes.

These panels consist of French plate glass set in steel frames having lugs fitted into recesses in the moulding. The structure is rigidly retained by an ingenious concealed spring that is operated by the fingers. Weaving or movement of the body and top is not communicated to the panels because of a patented construction of the top proper. When the panels are not in use they are stored in a compact, leather case, which is generally placed in back of the front seat, affording a location which is accessible without disturbing the occupants of the tonneau.

The door panels are practically a part of the doors and open with them and incline slightly inward, so that when the doors are closed they are practically spring fitted. This forms a sturdy construction and it is possible to slam the door shut without damage to the panel. This top provides a partially or wholly enclosed body, an advantage in cool weather, when it is desirable to shelter the occupants of the tonneau from dust and cool winds. With the rear panels in position back draughts are eliminated. When all the panels are in place the interior of the car is rain, snow, dust and wind proof and the construction is guaranteed against rattling, squeaking and vibratory noises.

A feature of particular interest is that a distinct design is made for each standard model car, the lines harmonizing perfectly with the body of the car. The first cost is the only cost and there is



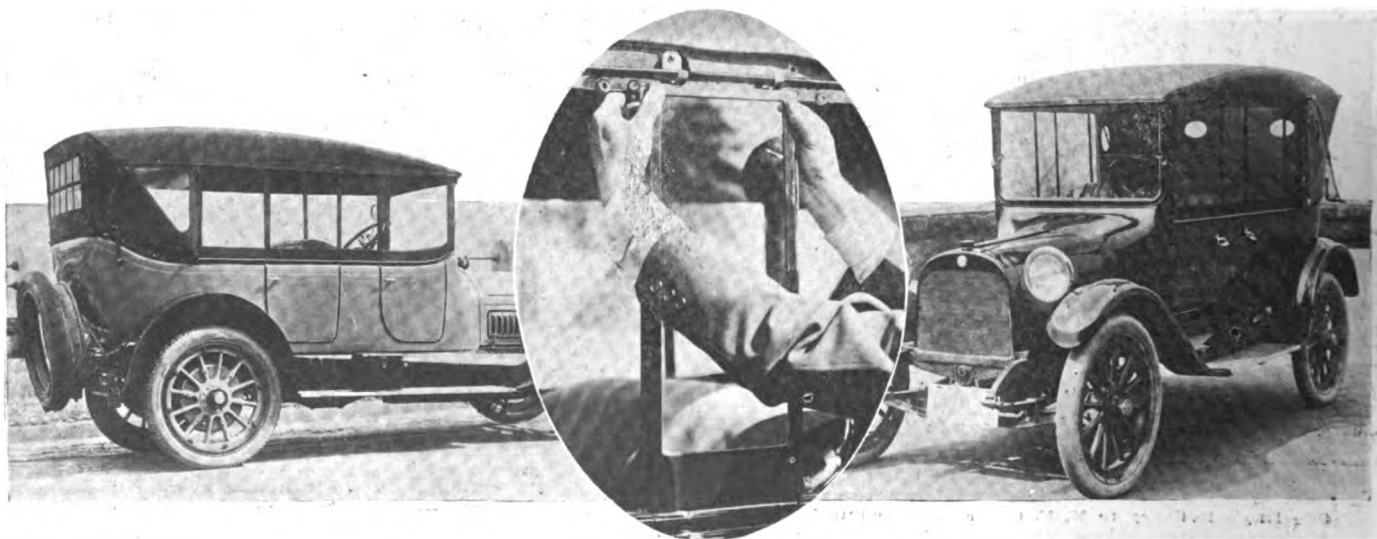
no varnish to require careful washing. The removable panels make for easy and convenient cleaning.

Manufactured by the Adams-Williams Manufacturing Corporation, 1790 Broadway, New York City. Further information and prices may be obtained on request by addressing the maker as above.

F. & R. AUTO VISE.

Included in the complete line of F. & R. vises is the one shown herewith, which is designed for use on the automobile. The tool can be conveniently clamped on the running board of the car or on the bench in the garage. Weighing but 7½ pounds, it can easily be carried in the car. The width of the jaws is two inches and they have an opening capacity of two inches.

Manufactured by the Fulton Machine and Vise Company, Lowville, N. Y. List price of vise having plain jaws and finished parts is \$8.50. When jaws and finished parts are nicked, the price is \$10.



TENOX LIQUID GASKET.

Paradoxical as it may seem, gaskets can now be bought in liquid form and used to meet every requirement for



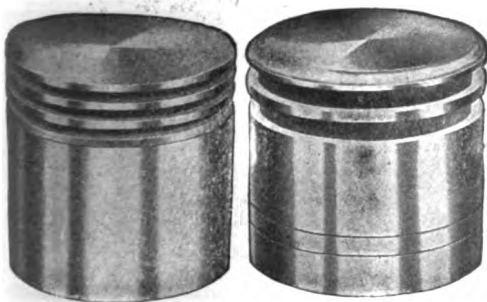
which copper, asbestos, fibre and other types are now used. The maker has given this preparation the name of Tenox Liquid Gasket, and advises that when it has congealed in position it is not effected by heat, water, oil or gasoline, and guarantees that it will not be blown out by any pressure to be found in present day gas engine construction.

The liquid is applied to the faces of flanged joints with a brush, it filling up all irregularities that may be present and automatically adjusting itself before hardening to meet every requirement. It is now being used by a large number of leading engine builders, two of which are the Buffalo Gasoline Engine Company and the Continental Motor Company, both of which indorse the preparation with the statement that fulfills perfectly all the functions of a gasket. Tenox Liquid Gasket is sold in cans of various sizes, they ranging from $\frac{1}{4}$ pint to one gallon.

Manufactured by the Stone Manufacturing Company, 136 Liberty street, New York City. List price of $\frac{1}{4}$ pint, 20 cents; prices of larger quantities quoted on request.

DYER PISTONS.

Dyer pistons are designed to afford long and satisfactory service and are made of the best materials and by the best class of workmanship. Standard and over sizes are always carried in stock for the Ford, Buick and Overland cars. They have individual cast rings and a ground finish, and together with numerous other features give exceptional value for the money. The maker also has patterns for the pistons of the ma-



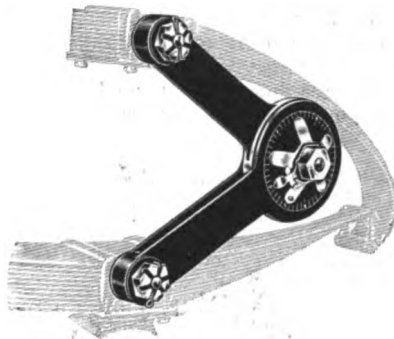
jority of other cars and can make them to order at short notice.

Manufactured by the G. H. Dyer Company, Cambridge, Mass. The maker solicits inquiries and will upon request quote prices.

HARTFORD SHOCK ABSORBER.

Hartford shock absorbers are made in six models, the latest type of which is termed the "heavy car special." It is the well known racing car model, and has been successfully used in all the big track, speedway and road races during the past season. The purpose of these absorbers is to stop jolting, jarring and vibration, eliminate side sway, prevent spring breakage and insure longer life to the tires and car. Each set, consisting of four absorbers, is complete and ready to attach. A detailed blue print, showing method of installation, is supplied. The Hartford service guarantee reads: "Money back if not satisfactory."

Manufactured by the Hartford Suspension Company, 170 Morgan street, Jersey City, N. J. List prices for cars over 4000 pounds, \$60; for cars over 3000 pounds, \$50; over 2000 pounds, \$40; up to 2000



pounds, \$25. A special set for Ford cars, consisting of three absorbers, sells at \$16.

NO. 68 GENERATOR.

The new Carleton No. 68 generator consists of complete electric lighting equipment for used or new cars and is guaranteed to afford a steady light either with or without a storage battery. Any six-volt storage battery may be charged by it. The instrument is easy to install, the drive is simple and positive and it is sold with a guarantee to meet all requirements. There is special equipment for the Ford, Saxon and Metz cars. This company also produces automatic cut-outs, ammeters, storage batteries and a 12-volt, 10-ampere generator.

Manufactured by the Carleton Company, 172 Summer street, Boston, Mass. List price, \$15.

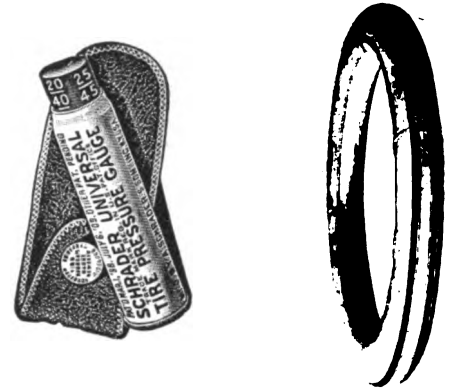
THE ALLEN TIRE CASE.

Several types of Allen spare tire cases are designed to prevent water, oil or heat from injuring the spare shoe. Each size is cut to accurately fit the make of non-skid or plain tread tire for which it was designed. They are manufactured also for demountable rims and wire wheels. At slightly higher prices imported materials in colors to match the car can be secured. Only the highest quality material and workmanship are used in these products.

Manufactured by the Allen Auto Specialty Company, 1926 Broadway, New York City. Write for prices.

TIRE PRESSURE GAUGE.

The only satisfactory method by which a motorist can determine the air pressure in the tires is to test it with a re-

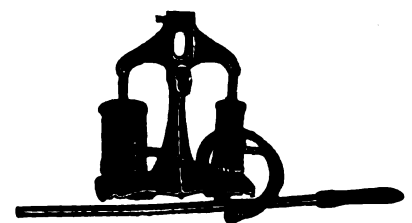


liable pressure gauge. The Schrader universal tire pressure gauge, shown in the accompanying illustration, is a satisfactory instrument for this purpose. The exact pressure in the tire can be ascertained at any time by removing the valve cap and pressing one end of the gauge down on the stem. The amount of air in the tire will be indicated by the figures on the plunger. Absolutely no pressure is lost by applying the gauge, as it connects hermetically with the tire valve. It is enclosed in a leather case.

Manufactured by A. Schrader's Son, Inc., 800 Atlantic avenue, Brooklyn, N. Y. List price, \$1.

STEVENS COMPOUND PUMP.

Inflating tires by means of a hand pump has always been considered a laborious task and in the majority of cases has been the cause for motorists using tires that are underinflated. There are hand pumps, however, that are designed to relieve the hard labor, and one of the best known of these is the Stevens No. 99 pump, which is of the compound type. One of the cylinders has a bore of $3\frac{1}{2}$ inches and the other two inches. In operation the air is pumped through the larger cylinder into the smaller and the resulting compressed air is then passed on into the tire of the tank. Brass is used throughout in the cylinders, bases and ground valves. The pump is guaranteed to maintain 200 pounds pressure, and each is supplied with three feet of high-grade hose and improved Acorn connection. A hard

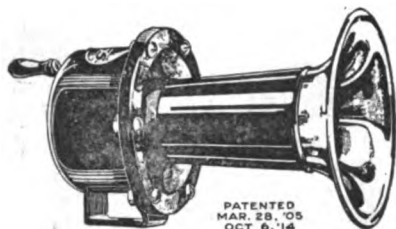


wood base and operating lever are also included.

Manufactured by Stevens & Co., 272 Broadway, New York City. List price, \$12. A pressure gauge is furnished for \$1 extra.

SEISS WARNING SIGNAL.

The Seiss model A warning signal is a double acting mechanical horn, which produces a powerful, commanding blast.



It is operated by revolving the knob handle at the back, either to the right or left. With this horn the operator is able to modulate its tone to a short, low signal, or intensify it to a sharp shriek. These tones can be made short or continuous as desired. Each instrument is sold with a 10-year guarantee.

Manufactured by the Seiss Manufacturing Company, 444 Dorr street, Toledo, O. List price, \$4.

FAULTLESS AIR COMPRESSOR.

The Faultless air compressor, shown in the accompanying illustration, is a single-cylinder, valve-in-the-head, air cooled machine. The cylinder has a bore of three inches and a four-inch stroke and at a speed of 300 revolutions per minute will deliver about five cubic feet of free air, and $6\frac{1}{2}$ cubic feet at a speed of 400 revolutions. The flywheel is 14 inches in diameter, with a two-inch face, and is securely attached to one end of the crankshaft. At the other end are a tight and loose pulley. These are 13 inches in diameter and have a $2\frac{1}{4}$ -inch crowned face. The combined weight of these pulleys is about the same as that of the flywheel, thus insuring a steady running, perfectly balanced machine. The crank case is of the inclosed, dust proof type. Lubrication is by the splash system, eliminating grease and oil cups. Only the best of material is used throughout the construction. The base, cylinder, piston, flywheel and pulleys are close grained iron, while the connecting rod, all bearings and bushings are of bronze.

Between one and two horsepower is required for operation, this depending of course on the speed and air pressure. The finish is in engine green enamel.



with aluminum trimming. The machine weighs 130 pounds complete and requires a floor space of 15x19 inches. This company also produces complete systems, including tanks, pipes, valve connections,

etc. Write for air compressor and engine catalogues.

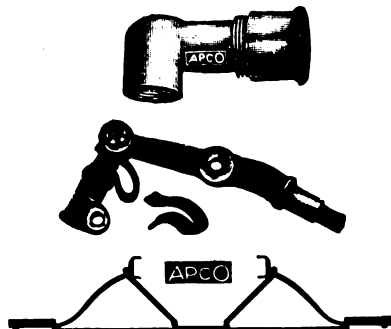
Manufactured by the Faultless Engine Company, Kansas City, Mo. List price, \$32.90.

APCO SPECIALTIES FOR FORDS.

The line of Apco specialties for the Ford car has been increased by the addition of the three new devices illustrated herewith. The Apco spindle silencer consists of a steel spring that is inserted between the spindle arm and connecting rod. It can be installed in a few seconds with a pair of pliers and is guaranteed to prevent rattling and lost motion. The set consists of two silencers.

The Apco fan grease cup extension is designed to bring the grease cup to the side of the fan, making for convenience and accessibility. The extension is screwed on to the bracket. It has an ample sized passage for the grease, which insures proper lubrication of the fan shaft and it can be installed without removing the bracket.

The running board trusses, consisting of six pieces to the set, can be attached



by use of an ordinary wrench. They reinforce the light rods supporting the running board braces, eliminate sagging, rattling and squeaking of the fenders and apron and prevent tearing of the mud guards at the points of attachment to the boards.

Manufactured by the Auto Parts Company, Providence, R. I. List price of spindle silencers, 35 cents per set; fan grease cup extension, 35 cents, and the set of running board trusses, \$2. All specialties are sold with the company's money back guarantee.

HARVEY SPRINGS.

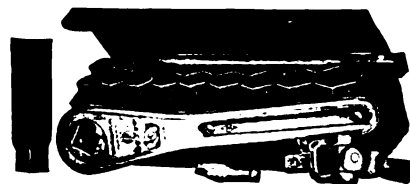
Harvey boltless auto springs are made without a hole at the centre and are guaranteed perfect from end to end. The plates are scientifically formed and tempered on the Harvey patented machines, which insure their accuracy and uniformity. Instead of a centre bolt, a small depression or bead performs the work of preventing the plates from shifting. This construction preserves the strength at the centre.

Manufactured by the Harvey Spring Company, 851 17th street, Racine, Wis. Carried in stock by all leading dealers.

MOSSBERG WRENCHES.

Among the many Mossberg wrenches and specialties designed for automobile

usage is the No. 16 socket set, shown in the accompanying illustration. It is a very good assortment for the owners of small cars, consisting of nine hexagon sockets, four square sockets and one



spark plug socket. The remainder of the set includes a reversible ratchet handle, universal joint, long extension tube and screw driver bit, all of which are packed in a neat fibre box. All components are fully guaranteed.

Manufactured by the Frank Mossberg Company, Attleboro, Mass. List price, \$16.

DU PONT FABRIKOID.

The automobile is one of the luxuries that many are now enjoying. To some people this vehicle is not considered a luxury, but to the majority of wage earners it is, hence such people have to exercise the uttermost care in selecting one. It is estimated that about 75 per cent. of the cars that will be sold in 1916 will sell for \$1000 or less each. An interesting feature noticed is that the manufacturers in purchasing upholstering material are in most cases avoiding split leather. Statement is made that at least 60 per cent. of all standardized cars will be upholstered in Fabrikoid.

Motor quality Fabrikoid is said to be stronger than split leather. High-grade artificial leather is water proof and washable and is guaranteed against cracking or peeling for a year.

The water proof feature is of the greatest importance, as automobiles must go through many severe rain and snow storms. Besides this, in the dry seasons, they must operate through dust and must be cleaned frequently.

The fact that more than 60 per cent. of all automobiles being manufactured in 1916 are upholstered in motor quality

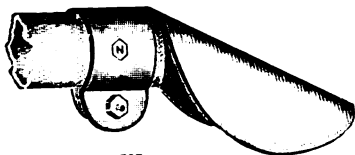


Fabrikoid after a year's test on many thousands of cars, demonstrates the value of this material.

Manufactured by the Du Pont Fabrikoid Company, Wilmington, Del.

EXHAUST DEFLECTOR.

Illustrated herewith is a device designed to clamp around the end of the exhaust pipe to allow it to be easily



PAT. APPL'D. FOR

turned in any direction. It is especially desirable for deflecting the hot exhaust gases from the rear lamp or tires carried at the back of the car. This article does not impede the exhaust in any manner. It is finished in black enamel.

Manufactured by the A. Nelson Manufacturing Company, 564-572 West Randolph street, Chicago, Ill.

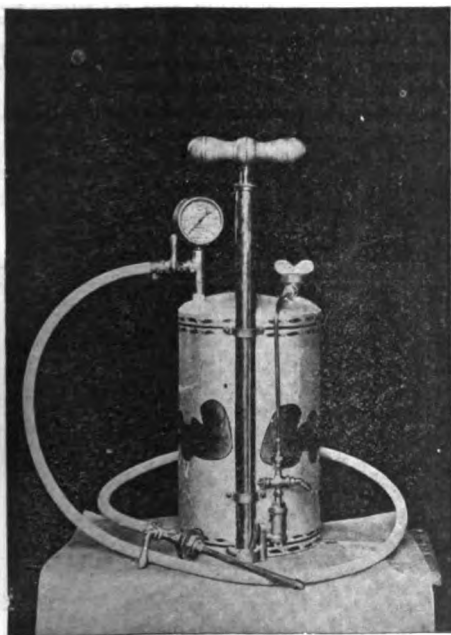
WINDSHIELD CLOTH.

Windshield cloth is a material which is chemically treated to prevent rain, mist or any other element of moisture from adhering to the exposed glass surface during storm. This cloth is free from fat and will not burn. It may be applied without risk of soiling even white gloves. The life of the cloth is from five to six months. It is packed in a neat container and is convenient to carry.

Manufactured by the Central Agency Company, Rialto building, Kansas City, Mo. Price will be supplied by the company.

AUTO ENGINE CLEANER.

The auto engine cleaner, illustrated herewith, is designed to expedite and aid in thoroughly cleaning the automobile engine. It consists of a three-gallon, seamless, galvanized steel tank, with



special hand pump attached, gauge, safety valve, gasoline inlet, cock for air inlet, spray nozzle with sprayer and cock and 10 feet of flexible tubing. The operation is simple. Fill the tank about two-

thirds full with gasoline. Close the outlet cock on the tank and pump up a pressure of 80 to 100 pounds. Close the air inlet cock and by opening the remaining two cocks the spraying action is begun. The advantage of this system is that the operator's clothes are not soiled and he is permitted to stand upright at all times. The powerful stream is said to cut away all gummy substances, fine sand and dust without any splashing. Kerosene, instead of gasoline, can be used if desired.

Manufactured by the Cleveland Faucet Company, 706-708 Frankfort avenue, N. W., Cleveland, O. List price, \$20.

BASELINE AUTOLINE.

The Baseline Autoline is intended to aid the driver when his car is stalled in deep sand or mud. One end can be attached to a pole and the other wound round the rear wheel hub, so that the car can pull itself out. It is designed for towing a disabled car to the repair



shop. The Baseline Autoline is made of yellow strand power steel wire closely woven into a quarter-inch rope. This is the same material as used in the well known hoist ropes which this manufacturer produces. At each end is a steel hook securely attached. Quick attachment to the car is made possible by there being two half-inch manila rope slings, which are furnished with each line.

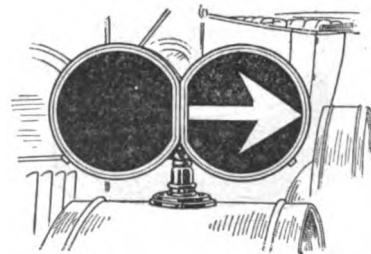
Manufactured by the Broderick & Bascom Rope Company, St. Louis, Mo. List price, including the two slings, is \$3.95.

AUTO DIRECTION SIGNAL.

Statistics indicate that 65 per cent. of automobile accidents are due to the fact that the drivers gave the wrong signal, or that the signals given were either unseen or misunderstood. The maker of the Auto Direction Signal declares that if cars were equipped with his signal such accidents would be practically impossible.

These signals, one of which is illustrated herewith, incorporate the use of flash lamps on which are illuminated arrows that can be seen either at day or night at a distance of at least 100 feet, which is ample under most conditions of traffic. They are operated usually from the steering column by pressure on the two buttons provided, and are located at both front and rear of the car. When it is desired to signal a right hand turn the button at the right is pressed and the

lamps behind the arrows indicating the direction of turn are illuminated. For a left turn the left button is pushed down. For a full stop the operator pushes down both buttons simultaneously and instant-



ly the stop arrow is shown at both front and rear.

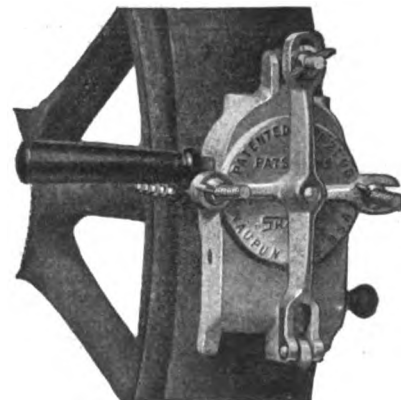
The signals can be easily attached to any car having electrical equipment, and they are an ornament rather than a detriment to the general appearance of the machine. All wiring is concealed under the fenders and body and no clumsy brackets are used.

Manufactured by the Auto Direction Signal Company, 505 Fifth avenue, New York City. List price of complete equipment ready for use \$35. Descriptive circular furnished to inquirers.

VULCANIZING OUTFIT.

Practical motorists are saving money by vulcanizing their own tires and tubes, which is made possible through the development of outfits that can be successfully operated by anyone. One of the most efficient on the market is Shaler's Safety Vul-Kit, illustrated herewith. Heat is supplied by either alcohol or gasoline. Over or undercuring are said to be impossible, and the fuel is so guarded that it is impossible to spill the blazing liquid, even if the vulcanizer is upset. An interesting feature is that the blaze is not exposed, thereby enabling its use close under the fenders without possibility of scorching the paint. Besides making every practical kind of tube repairs, the instrument has a curved surface adapted to any size tire for mending casing injuries. It is carried in a strong telescope case, which will fit in the tool box.

This company also manufactures electric vulcanizers which can be used in connection with city lighting current.



Persons interested should write for the free catalogue.

Manufactured by the C. A. Shaler Company, 259 Fourth street, Waupun, Wis. List price, \$3.50.

LAPPING COMPOUND.

The Burdingco lapping compound is said to have completely revolutionized the method of lapping piston rings. It



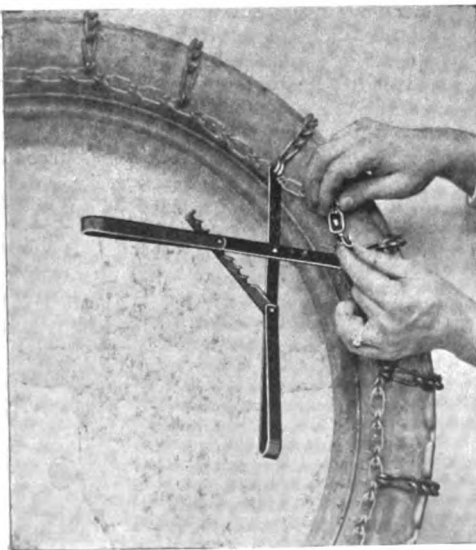
is a light abrasive material, which wears lightly into the newly ground or glazed cylinder walls and quickly produces the satin like finish that develops when wearing parts are properly seated. When the engine is fully assembled and the crank case filled with lubricating oil, the motor is started and about a thimble full of Burdingco lapping compound allowed to seep in slowly through the air intake of the carburetor. After the engine has run for about a half hour the lapping operation is completed.

It is not necessary to drain the crank case or use any cleansing agent after the operation. A peculiar characteristic of this compound is that it retains its abrasive qualities for only a short time, and although it may work into the crank case, it cannot possibly do harm to any working part. This process is not an experiment and is used by many of the largest manufacturers.

Manufactured by the Burd High Compression Ring Company, Rockford, Ill. Write for prices.

TIRE CHAIN HOOKER.

The Foster tire chain hooker is a little tool that greatly simplifies the operation of attaching tire chains and prevents torn and scratched hands and removes the necessity of tugging and pulling to



clamp the chains together. Two hooks of the tool engage the chain links on either side of the fasteners and all slack is easily taken up by drawing the two handles together. When the chain is

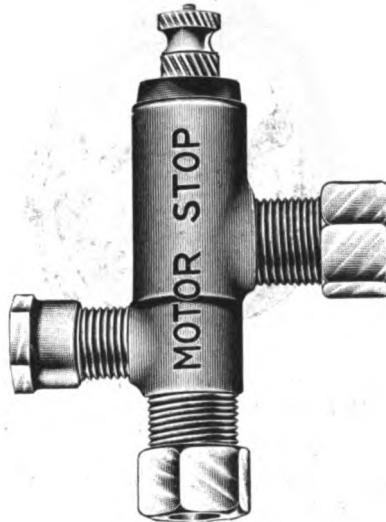
drawn sufficiently tight so that the two ends overlap, the operator slips the ratchet into a notch and the tool will hold the chain in the position shown in the illustration.

This tool is also helpful for removing chains, especially if they are muddy or rusty. It is 13 inches overall and folds compactly to fit into the tool box. It is finished in black japan.

Manufactured by the Foster Brothers Manufacturing Company, Utica, N. Y. List price, 50 cents.

AUTOMATIC MOTOR STOP.

The purpose of the Pagel automatic motor stop, shown in the accompanying illustration, is to shut off ignition when the oil in the crank case becomes exhausted or the circulation clogged. It is designed to be installed in the lubricating oil line of any system, whether pressure, gear or plunger pump. Should the circulation become impeded, the motor is automatically stopped before damage



is done. This is accomplished by attaching the ground wire from the magnet to the terminal at the end of the device. Installation is simple, requiring only the cutting of the oil pipe and the inserting of the motor stop.

Manufactured by the Turner Brass Works, Sycamore, Ill. List price, \$1.

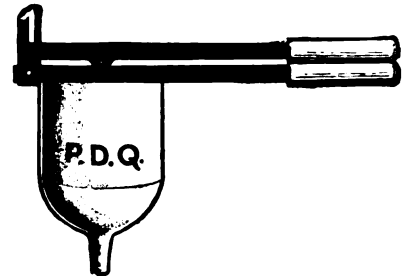
DIXON GRAPHITE.

Dixon automobile graphite lubricants are known and used everywhere because they are a positive reducer of friction. Racing drivers, who demand a dependable lubricant, almost universally use the Dixon products in their cars. The manufacturer is prepared to supply free on request to anyone its booklet 49 G, which contains unqualified endorsements and portraits of leading racing drivers, besides valuable information concerning lubrication. A feature of graphite lubricants is that they are unaffected by even the most radical changes in temperature.

Manufactured by the Joseph Dixon Crucible Company, Jersey City, N. J. Sold by every reputable dealer.

P. D. Q. GREASE GUN.

The advantages claimed for the P. D. Q. grease gun, shown in the accompanying illustration, are power, durability and



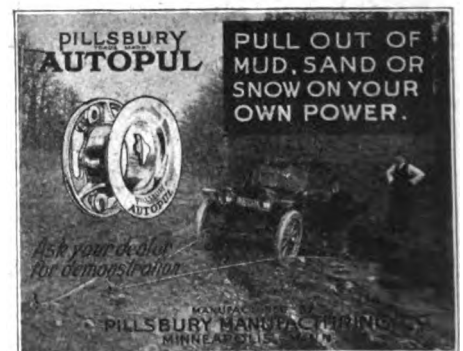
quickness of operation. The plunger lifts out with the handle, allowing the operator to use a paddle to load the gun through the open end. One downward stroke of the plunger forces out the entire supply of grease. Statement is made that 18 ounces of grease can be discharged per minute, and without soiling the operator's clothes or hands.

Manufactured by the Star Brass Works Company, Kansas City, Mo. List price, \$2.50 each.

PILLSBURY AUTOPUL.

The Pillsbury autopul, illustrated herewith, is a device designed to enable an operator of an automobile or truck which has lost traction to utilize its power to get out of the trouble. The equipment consists of two specially constructed winding drums, or reels, 50 feet of Manila rope with a hook spliced in each end, and all necessary locking nuts and bolts. The drums attach to each rear wheel hub flange by special projecting locking nuts and are easily locked without the aid of tools.

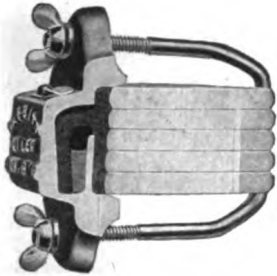
The rope, or cable, which is used for truck models, is hooked into a small opening in each drum and wrapped once around to relieve the strain from the small hook. The rope is then carried forward or backward from the under side and anchored to a stake, telegraph pole or any other stationary object. The motor is then started and the slipping wheels cause the cable to be wound around the drums and gradually pull the machine onto firm surface.



Manufactured by the Pillsbury Manufacturing Company, 322-24 Hennepin avenue, Minneapolis, Minn. The prices range from \$10 to \$35. Write for further details.

BABBITT SPRING OILER.

Experts advise that every part of the automobile is seriously injured and hampered in its work by excessive shock



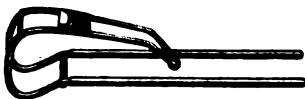
and vibration due to retarded spring action, which is the result of inadequate lubrication between the spring leaves. With the use of the Babbitt spring oiler it is possible for constant lubrication to be effectively applied automatically. It is a neat, sturdy and compact device, which fits snugly against the outside of the spring. The oiler is equipped with a reservoir from which the lubricant is withdrawn by the capillary, vacuum process. A feature of interest is that this attachment can first be used for cleaning the rust from springs, and for this purpose kerosene is used instead of lubricating oil. After following this process for a week, a light grade of engine oil may be used in the oiler and the surface of all the spring leaves will be effectively lubricated. The lubricant is replenished once a week through an oil hole in the cover, the operation requiring but a minute.

A summary of the advantages gained by the use of these oilers are maximum comfort, decreased engine troubles, decreased danger from broken springs, prevention of spring squeaks and less road racking of the car.

Manufactured by the Babbitt Spring Oiler Company, 601-5 Penn building, Cleveland, O. Write for descriptive matter and price list for the different makes of springs.

WINDSHIELD CLEANER.

The Clear-O-Scope auto windshield cleaner, illustrated herewith, makes pos-



sible the clearing of rain, snow or fog from the glass while driving. It readily slips over the windshield, and is operated by sliding back and forth. One

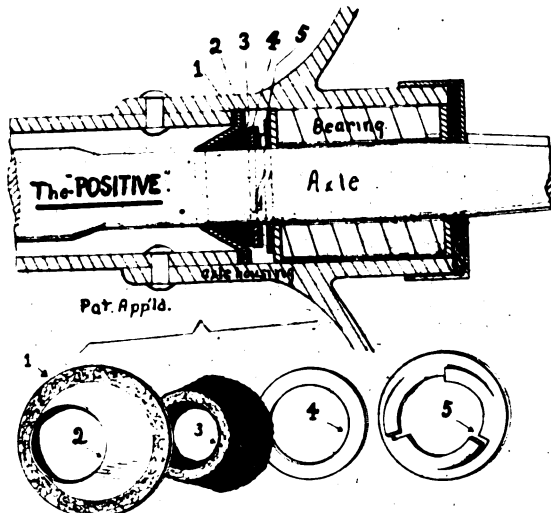
operation cleans and dries the glass. There is no rattle as spring tension holds the cleaner firm at all times.

Marketed by the Zinke Company, 1322-26 Michigan avenue, Chicago, Ill. List price, \$1.

POSITIVE GREASE RETAINER.

Owners of Ford cars who are using greases which leak out at the axle ends will be interested in the grease retainer, illustrated herewith. It is known as the Positive and consists of a cone-shaped retainer, Fig. 2, engaging a heavy felt washer, Fig. 3, which is held in position and concentrated by a spring thrust washer, Figs. 4 and 5. The wear to which the felt is subjected is compensated by this construction and a grease tight joint around the axle is always assured. A felt gasket, Fig. 1, between the retainer and the shoulder of the axle housing also insures a grease tight joint at this point. The Positive is guaranteed to stop rear axle grease leakage during the life of the car.

Manufactured by the Petersburg Spe-



cialty Manufacturing Company, Petersburg, Ill. List price, \$2 per pair.

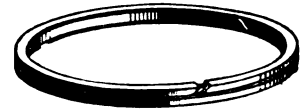
TRUMP PISTON RINGS.

Trump multiple piston rings are said to be ideal for the permanent conservation of power and the prevention of excess carbon in automobiles, motorcycles, aeroplanes, cyclecars, tractors, gas engines, motor boats, etc. These rings are composed of three sections, each having equal resiliency and expansion, and when assembled form a whole that gives uniform pressure at all points on the inner wall of the cylinder. On the assembled ring the three openings of the sections are equally spaced, thus forming an impregnable barrier to the escape of gas and compression.

Trump multiple piston rings are made of a close grained iron of a special formula. Each is ground to less than a thousandth part of an inch, insuring extreme accuracy in fit to the cylinder. Fitting one Trump ring in a cylinder will materially improve compression, but the maker advises that it is better to completely equip each piston with them so

as to overcome all uneven wear that results from using the eccentric ring.

All standard sizes of rings are carried in stock ready for immediate shipment.



Special sizes can be made to order at a reasonable price.

Manufactured by the Trump Manufacturing Company, Crown Point, Ind. Write for free descriptive booklet and price list.

AUTOMOBILE TOPS.

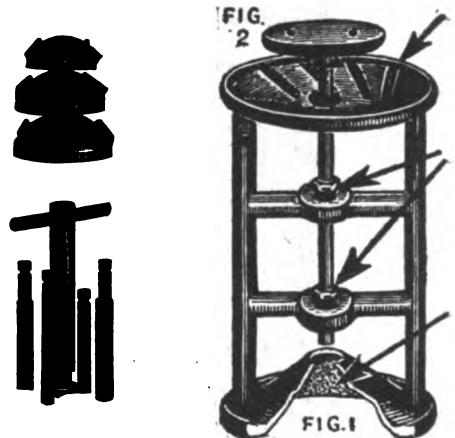
Experience has taught that the water proofed fabric covering of the top wears out long before the bows and other parts and to obtain full service from the parts the S. & H. covering has been designed to replace the old top. The manufacturer has developed patterns and is now able to furnish complete outfits for recovering any standard make of car. These consist of a complete roof, back curtains, etc., with or without curtains, and can be tacked on by any one. For other cars the maker supplies measuring blanks and instructions so as to permit of the making up of covers to order.

With either outfit the car owner can replace the top fabric in short time, resulting in the old top being as good as new. This work is done while the top is raised on the car. The old roof and back are removed, the bows being held in place by the streamers and padding. The S. & H. covering is then spread over and tacked in place.

Manufactured by the Split Hickory Wheel and Top Company, 1203 Sycamore street, Cincinnati, O. List prices range from \$5.95 and \$7.95.

BEAN VALVE TOOLS.

Ordinary grinding will not restore efficiency of operation if there is any unevenness of the valves and valve seats. Good results can be quickly obtained by first using the Bean refacing and reseating tools, illustrated on this page. The refacing tool consists of a reversible



frame, supporting at one end a disc for grinding, and at the other end a disc with spiral cutters for tooling the valve face. The adjustable bushings provided are adapted to reduction in the size of

the valve stem caused by wear, which insures perfect alignment.

The Bean reseating tool consists of a cutter, pilot and a cutter handle with lock nut. Various sizes of cutters are



made and they are of the finest steel, tempered and accurately ground.

Manufactured by the Bean Company, First avenue, Berea, O. Prices sent on request.

FIRE EXTINGUISHERS.

In the majority of cases automobile fires occur when least expected and if some means is not at hand to cope with this condition, complete destruction of the car is the inevitable result. This fire factor is recognized by auto insurance companies and they base their rates accordingly. One of the best fire extinguishers on the market and one which is convenient to carry on the machine is the Pyrene fire extinguisher, illustrated herewith.

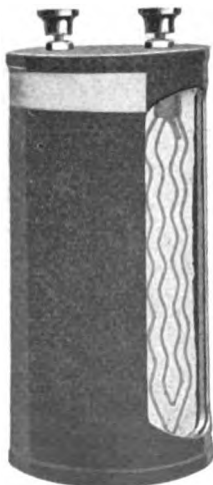
Besides providing the motorist with a safeguard, the extinguisher can be used to advantage in quenching flames in the home, garage, or, in fact, any place where fire may spring up. The standard equipment for the Pyrene is one quart capacity contained in a brass and nickel cylinder, which is very light and convenient to handle.

These extinguishers can be purchased from almost any dealer in the country, even in the remote communities, or direct from the maker.

Marketed in New England by the Pyrene Manufacturing Company, 88 Broad street, Boston, Mass. List price complete with automobile bracket, \$7.50. Write for the interesting booklet entitled "Fire Fotos."

VENUS DRY STORAGE BATTERY.

In the accompanying illustration is shown the Venus dry storage battery, designed for ignition and lighting pur-



poses and all other work where high amperage is essential. It is of approximately the size of the standard dry cell, but is said to give over six times greater

efficiency and life. It is obvious that with a discharging rate of three amperes for 12 consecutive hours this battery is adapted to an almost limitless variety of uses.

Instead of liquid electrolyte, a compact, solid mass is packed close around the plates. The electrolyte used is prepared from a secret formula and absolutely cannot spill or leak from the battery. No additional moisture is required. A mineral condenser at the top automatically returns all evaporated moisture to the electrolyte, thus insuring almost perpetual life. The plates are a departure from the conventional type, they being of an endless construction. The case is of turnplate steel, lined with acid proof material, insuring great rigidity and long life.

As the recharging cost of the Venus battery is but a few cents, the purchaser will be afforded a saving in money, time and trouble. All batteries are guaranteed to be free from defects in material and workmanship.

Manufactured by the Venus Electric Lamp Company, 64 Second avenue, Detroit, Mich. List price, \$2.

CARDS SCREW PLATES.

The No. 5 Diamond screw plate, illustrated herewith, is especially designed



to meet the requirements of automobile repair work. It contains three screw plates in one, having an assortment of machine screws, U. S. standard or V standard, and S. A. E. standard sizes.

The outfit consists of 23 plug taps, 23 round, adjustable dies, two adjustable tap wrenches and two die stocks. Each member of the equipment is guaranteed to be of the best material and workmanship. The complete outfit is packed in a hard wood case and is easily carried.

Manufactured by the S. W. Card Manufacturing Company, Mansfield, Mass. List price, \$24.

SAFETY FIRST BLOW OUT PATCH.

The Polson Safety First blow out patch is so designed as to encircle the inner tube and to be held in position by a self-adjusting strap. When the tube is inflated it is said that the patch expands at the ends and tightens at the centre, thus preventing it from pouching and enlarging the hole in the outer casing. The maker warrants it to be proof against rim cuts or side blow outs. The patch is made of extra stout white friction fabric and vulcanized over molds, insuring a perfect fit. As a pre-

caution against cutting or pinching the tube, the ends are made of rubber. These patches are made in 10-inch lengths and the diameters vary by half inches from three to five inches.



Manufactured by the Polson Rubber Company, Kansas City, Mo. The price varies according to size, ranging from 80 cents to \$1.40 each.

BLUE RIBBON SPECIALTIES.

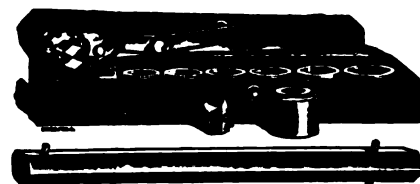
In the fact that Blue Ribbon products are described, priced and, specialized in more than 95 per cent. of the American jobbers' catalogues can be found indorsement of their quality and moderate cost. They are being used extensively by all classes of motorists and on all kinds of cars. The Blue Ribbon cream metal polish is intended for use on any metal, especially on brass, copper and nickel, and requires very little effort to produce a mirror-like brilliancy. Because of the enduring quality of its lustre, frequent polishing of the parts is unnecessary.

The Blue Ribbon line of specialties is very comprehensive. Two new products, which will be featured in the national window display contest the maker is about to inaugurate, are the black gloss enamel for retouching and refinishing worn or damaged metal parts, and auto top, seat and lining dressing for refinishing and water proofing leather, mohair, panasote and their substitutes.

Manufactured by the International Metal Polish Company, Indianapolis, Ind.

UNIQUE RATCHET WRENCH.

One of the chief advantages of the Lane unique ratchet wrench is that it is adapted to close and difficult work which ordinarily could be done only with a cold chisel. It consists of a long ratchet handle, cold broached, case hardened steel sockets and screw driver bits. It is so constructed that nuts located close to walls can be turned easily. The sockets are warranted not to break or split and will fit three standards and automobile nuts.

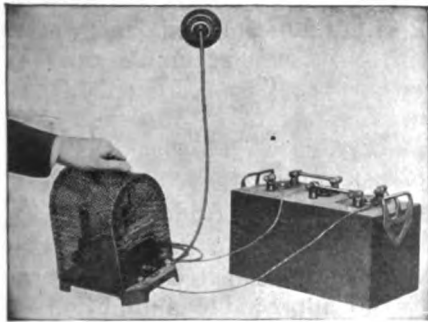


Manufactured by Will B. Lane, 180 North Dearborn street, Chicago, Ill. List price of standard set enclosed in leather case, \$2.50.

MOTOR STARTING AND CAR LIGHTING.

The Economy of Careful Maintenance of Storage Batteries and the Utility of Small Outfits for Frequent Overcharging by Owners Outside the Car.

MUCH greater satisfaction will be obtained by the owner or driver who gives careful and systematic attention to the electrical equip-



Rocking Small General Electric Rectifier for Ignition and Lighting Battery Work.

ment of his car. There is seemingly very general belief that an engine can be started as frequently as desired and current supplied the lamps as long as these are

lighted, without much, if any, care of the battery from which energy must be drawn. And yet the battery is the most important part of the system.

Practically all starting and lighting systems are developed for use with lead-acid batteries, which have positive plates of lead peroxide and negative plates of sponge lead, and electrolyte that consists of dilute sulphuric acid, the proportion being determined by the volume of acid necessary to mix with distilled water to obtain specific gravity of 1.300 at a temperature of about 85 degrees Fahrenheit when the battery is fully charged.

The purpose of this article is to deal with one phase of maintenance that is absolutely essential to efficient starting and lighting, and which will require but little of the time of the owner or driver. All lead batteries are built to the principle that the greatest efficiency can be obtained from charging eight hours and discharging eight hours. By this is meant that if it is charged at a rate that will bring the voltage up to the standard in less time the charging may be destructive. Rapid charging will cause gassing and this means increase of temperature and agitation of the electrolyte, accompanied by washing and more or less disintegration of the plates. The process may be slow, but it is nevertheless certain. Charging slowly reduces the gassing and minimizes "wear" of the plates.

Changes by Charging and Discharging.

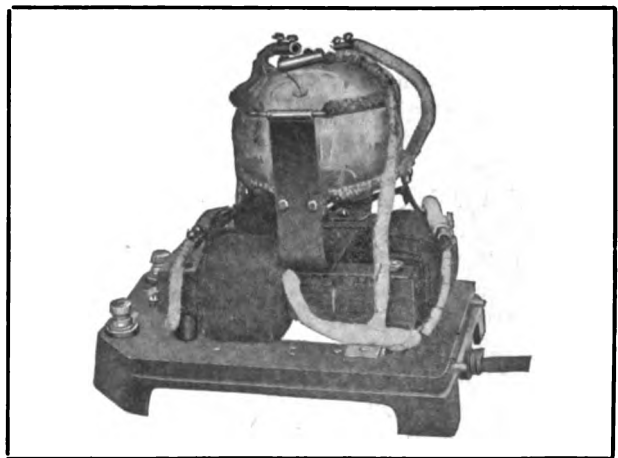
The process of charging changes the character of the positive plates from sulphate of lead to lead peroxide, and of the negative plates from sulphate of lead to spongy lead. Discharging the battery causes the plates to be changed to sulphate of lead, and too great discharge will de-

posit coatings of lead sulphate on the plates, which cannot be removed only by very long charges at very low rates. This transition of the plates from the one chemical substance to the other is absolutely necessary, despite the statements that certain lead-acid batteries are "non-sulphating" and must take place.

The life of a battery is represented by a number of cycles, that is, fully charging and fully discharging, and capacity is established by the area of the plates exposed to the electrolyte. For batteries where large capacity and light weight are essential the plates are comparatively thin, but where endurance is the first necessity and capacity and weight are secondary, the plates are thicker. The batteries used for starting and lighting are generally the latter type.

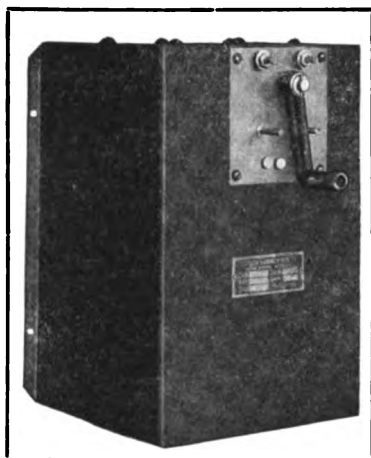
Battery Charged While Engine Runs.

Assuming a battery included in a starting and lighting system of a car, the generator is operating practically all the time the vehicle is driven, and is generating current save when moving very slowly. The usual value of the current is from 10 to 15 amperes, or sufficient to light the lamps. This current will, taking an average system as example, be generated at all speeds in excess of nine miles an hour, and the maximum will be reached at 15 miles an hour. During the operation of the car by day light the only current required is for starting the engine unless ignition current is also supplied. Assuming the average starting motor to be $\frac{3}{4}$ horsepower, the voltage six, the battery amperage 100, and that full power of the motor is necessary to start the engine.



General Electric Small Rectifier with the Mercury-Arc Cover Removed from Tube.

A horsepower electrically is 746 watts, and 560 watts is $\frac{3}{4}$ horsepower. Dividing 560 by the voltage (six) shows that approximately 93 am-



Cutler-Hammer New Type Rheostat for Small Battery Charging for Wall Installation.

peres is necessary for starting. This amperage is required whenever the engine is started, and assuming that 15 starts are made a day, and 10 seconds is sufficient for the engine to begin firing, this is a total of 150 seconds that the high amperage is drawn. The generator must be operated to capacity for approximately 15 minutes to replace the current used for starting, but considering that there are other losses of current, one may estimate that 60 minutes' charging are required. If the generator is driven several hours in excess of the time that will restore the current drawn from the battery this may be regarded as excess charging.

Large Variance in Demand.

Of course the battery may not have been fully charged when the car was taken out, but charging has been practically constant and the demand comparatively small. When the car is driven at night the current generated is practically all required for the lamps and for starting, so that ordinarily there should be very little, if any, loss in current from what the battery indicated before the evening driving was begun.

This explanation has been made to show that charging and discharging is very irregular and that only on rare occasions is there anything like the complete discharge that is really essential for long life of the battery. The charging in excess of the maximum rate will cause gassing, which is not noticeable to the driver because the battery is not convenient for observation, and this will dissipate the electrolyte with greater rapidity than might be assumed.

Damage from Loss of Electrolyte.

With the loss of volume of electrolyte the capacity of the battery is decidedly reduced, because this reduction exposes the plates to the air, and the loss is that ratio that the exposed area bears to the entire area of the plates. That is, exposing an eighth of the plates will reduce the battery capacity $12\frac{1}{2}$ per cent. The voltage will not indicate this lack of electrolyte, because voltage is represented by the difference in activity or potential between the plates, but it will be evidenced by loss of amperage.

The plates are intended to be submerged and exposing them to the atmosphere causes heating and disintegration, and a loss of activity. Plates that have been heated because of partial exposure can seldom be restored to full capacity.

even with careful treatment by expert battery men, and, of course, they are entirely beyond the attention that can be given by an owner.

The battery ought to be filled with distilled water at least once a week. No other water should be used. There is only one safe element,—distilled water—which can be easily obtained. Care should be taken in filling the cells to use vessels that are clean. Even dust may contain elements that will cause damage. The top of the battery should be cleaned with a cloth wet with a weak solution of ammonia and water, which will neutralize the accumulations of minute acid crystals that have been carried through the vents of the cells by the gas. The terminals and connections should be kept clean and free from corrosion.

No Acid Should Be Added.

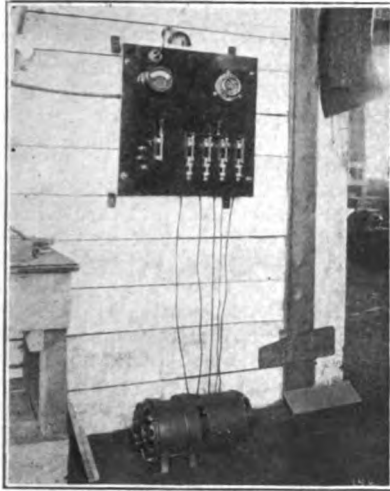
No acid should be placed in the cells. The acid of electrolyte is not dissipated by evaporation and there is no appreciable diminution of volume because of the minute quantities carried out in the hydrogen filled bubbles resulting from gassing. The battery should be tested with a voltmeter very frequently, twice a week is not too often, and the tests should be made at the conclusion of charging, while the current is still flowing. Besides this tests should be made with a hydrometer as a check on the voltmeter determinations. When fully charged the battery should indicate 1.300 in specific gravity, and it should never be discharged below 1.150.

The best battery engineers advocate the operation of batteries to conserve current and to obtain maximum life with as near complete discharge and charge as is possible. The ideal practise is starting with a long overcharge at low rate, the battery may be discharged approximately 95 per cent. and charged 95 per cent. for from six to 12 days, and then it should be given a long over charge, that is, the charging should be continued for not less than 12 hours at a low rate.

This will reduce the sulphation and restore the plates to the best condition obtainable. But the height of the electrolyte is to be maintained al-



Ohio Automatic Rectifier for Small Battery Charging.



**Lincoln Charger (Motor-Generator)
for Charging Ignition and Lighting
Batteries.**

ways above the plates, usually a half inch is sufficient.

No owner should attempt to renew the electrolyte by the addition of acid. First of all the sulphuric acid ordinarily sold as commercially pure is seldom free from impurities.

Second, the solution must be so proportioned that it will bring the volume in the cell up to required standard, which proportions cannot be determined save by those experienced in battery treatment. Third, the condition of the electrolyte as indicated by specific gravity does not always establish that the sulphuric acid radical or the sulphate remaining in the positive plates has been reduced by charging. The electrolyte may show weakness by specific gravity reading, and there may be sufficient acid retained by the positive plates to bring it up to standard when an overcharge has been given.

Partial discharge and fully recharging is not judicious unless the battery has been at least 50 per cent. discharged. The life of a battery is measured by a definite number of cycles, and while the current would necessarily be supplied, there is the deteriorating influence upon the plates.

Because of the peculiar requirements of the car lighting and starting system the same character of care that would be regarded as necessary with a battery used for other purposes is impossible, and aside from care in maintenance of the height of the electrolyte, keeping the specific gravity of the solution as near to the standard as is possible, the best attention can be given by systematic overcharging, say once in 10 days in summer and once in two weeks in cold weather, for from four to six hours more than the normal charging period of eight hours.

Charging with Small Outfits.

This can be done by the use of small charging outfits, which can be used with either alternating or direct current, and are adapted for connection with the average lighting circuit. These outfits are different types, either motor-generators, mercury-arc or vibrating rectifiers, that can be located on walls, benches or floors, that are extremely economical to operate and are practically automatic in their operation. These

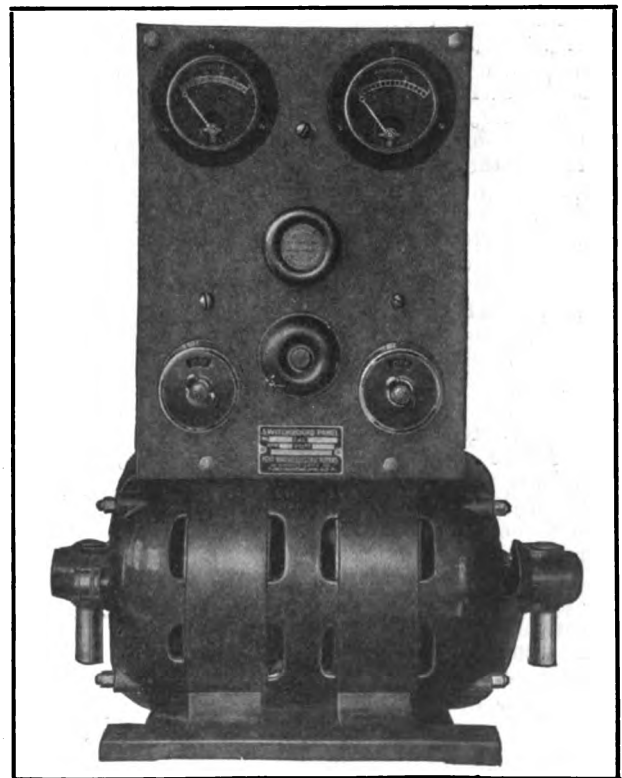
apparatuses have been designed for use in private and public garages and shops, and while they are most productive when used constantly, they are judicious investments for those who have but a single car and can use them merely for keeping the battery of the lighting and starting system in condition.

The direct economy is that the battery life will be prolonged, the service will be up to the expected standard, and "outside charging" that ought to be done at least once in two weeks, and which will cost considerable in aggregate, especially if done by those who will give individual attention to it, will be obviated. As a matter of fact the saving in "outside charging" ought to practically pay for the outfit in a season, to say nothing of longer life and better service.

(To Be Continued.)

SOUTH AFRICAN WANTS CARS.

H. V. Kilburn, 215 Longmarket street, Pietermaritzburg, South Africa, announces through the offices of J. E. Sitterley, foreign sales manager, 47 Broadway, New York City, that he would like to receive printed matter and prices on small low priced motor cars and also on electric runabouts. The business would probably be placed by J. E. Sitterley, who also would attend to payments and the shipment of goods.



**Fort Wayne Portable Motor-Generator Set for Small
Battery Charging.**

Manufacturers seeking satisfactory representation in South Africa should write direct to **M. KILBURN**, sending full details in the first letter.

THE USE AND ABUSE OF BALL AND ROLLER BEARINGS.

UNLESS the bearings of a motor car are kept in the condition intended by the manufacturer of the vehicle, it is impossible to obtain that efficiency of operation which every purchaser is led

that the radius of the curvature of the groove should be .53 to .55 of the ball diameter.

There are two principal directions of load application, that is, radial load act-

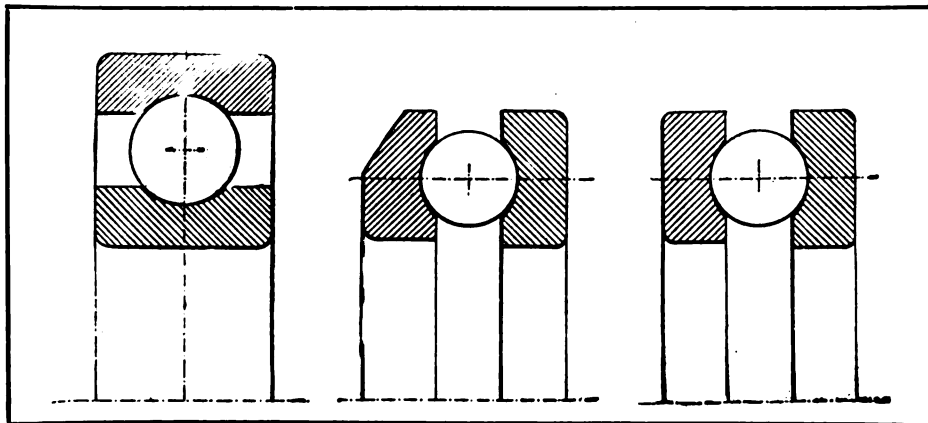
in two opposite directions.

In roller bearings there are two principal designs—one for straight radial loads, in which the lines of contact of the rollers with the races are parallel with the shaft axis, and a second one for combined radial and thrust loads, where the lines of contact of the rollers with the races and the axis of the rollers must meet at the same point in the shaft axis. Consequently, all diameters of the taper rollers at the point of contact with the races must be in the same proportion to the diameters of the races.

It is essential to keep the rolling members of ball and roller bearings in alignment. In ball bearings, where the balls are inserted in grooved races, they are compelled to keep their straight path in the centre of the groove. In roller bearings side shoulders on the races and a caging for the rollers are provided.

Adjustable bearings, whether they are ball or roller types, are not practical. In mounting new bearings of this type, they will be at the mercy of the man who has to mount them, as the proper adjustment depends on the fineness of the feeling of his hands. Therefore, it is to be expected that some times the bearings will be mounted too tight or too loose. In the former instance, the rolling members will be pressed tight between the races, which will cause an overload and increase of friction, noisy running and quick wear of the bearing. If the rolling members are adjusted too loosely, they will rattle, and in roller bearings the rollers will lose their alignment and will wedge, thereby producing great end thrust.

The idea that worn bearings may be adjusted is absolutely wrong, and even detrimental. The races and also the rolling members never wear off equally at all points, as the bearing is not loaded equally at all its portions. By tightening up on a worn bearing in order to eliminate the play, some of the rolling members will be jammed between the sound portions of the races, while the others will be loose between the worn portions. Furthermore, the rolling members will be pressed out of align-



Ball Bearing Designed for Radial Loads (Left), Ball Bearing for Thrust Loads (Centre), Another Design of Thrust Ball Bearing (Right).

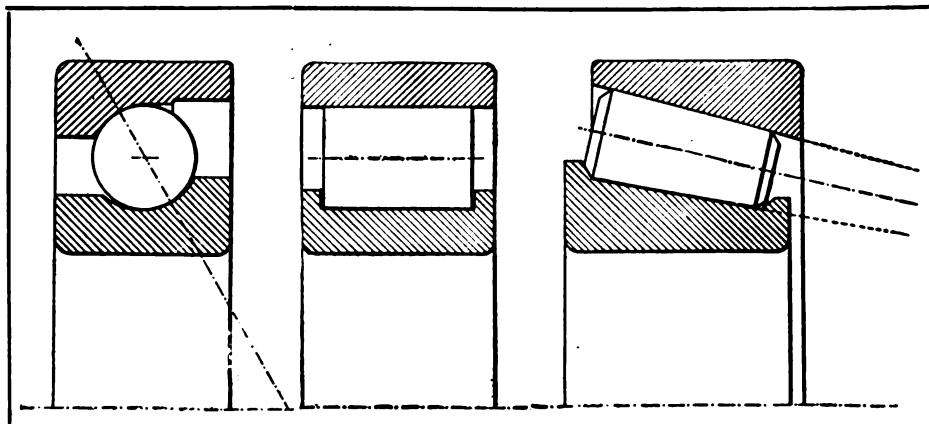
to expect. It seems unnecessary to state that the prime purpose of bearings is to overcome the friction that would otherwise arise through working parts contacting with each other. To obtain this condition the bearings must be properly adjusted and they must be lubricated with reasonable frequency and with the proper lubricants.

Not every car operator understands the correct method of caring for bearings. For such persons the following discussion, which is based on data by F. J. Jarosch, a recognized authority on the subject of bearings, will be found to be invaluable in preparing the car for service, especially as regards the overhaul of the units in which either ball or roller bearings are incorporated. In order that the owner may approach the task with full understanding, the discussion has been composed by progressive steps, dealing with the types, the processes of manufacture and proper method and kinds of lubricants to be used in maintaining perfect operation. As regards lubrication, there have been several cases in which the failure of driving parts of an automobile was laid to graphite lubricants, but careful investigation showed the cause to be due to incorrect application, mounting or treatment of the bearings, causing an incorrect co-operation of the gears, etc. By observing the suggestions and rules as given in the following article, such cases can be easily eliminated.

Types of Bearings.

Referring to ball bearings, extensive research has revealed that the highest carrying capacity of a ball bearing of a given material can be obtained by placing the balls in grooved races, where they should be in contact only at one point on each race, and these points of contact should lie in the direction of the load. Observing the best relations between the friction and carrying capacity, practical experiments have determined

ing at right angles to the shaft axis, and an axial or thrust load acting in parallel direction. Conceding these conditions, two different designs of ball bearings resulted, one for radial loads and one for thrust loads. Another design of ball thrust bearings has two flat washers, that is, the surfaces are parallel. Since inaccuracies of the mounting parts, or deflections of the shaft, due to the load, are apt to disturb the parallelism between the seat on the shaft and the seat in the housing, which would result in an overloading of the balls on one side of the bearing, the design first referred to is considered to be the better one, as the spherical seat in the housing allows a self-aligning movement of the bearing. There is also another design shown herewith, for combined radial and thrust loads. The bearing for radial loads and the one for combined radial and thrust loads are also made as double-row bearings, to obtain a larger carrying capacity without increasing the inside or outside diameter of the bearing. Thrust ball bearings are also made as single and double acting bearings, the latter being designed to take thrust load



Combined Radial and Thrust Ball Bearing (Left), Roller Bearing for Straight Radial Loads (Centre), Roller Bearing for Combined Radial and Thrust Loads (Right).

ment and also will have to run over uneven parts of the race way. This condition will very soon lead to an entire destruction of the bearing, besides giving trouble during its operation.

ways and rolling members are ground, and should be highly polished, because the smoother the surface the less friction will be produced.

The balls or rollers should be abso-

Bear. Nos.	Outside Diameter		Inside Diameter		Width for Both Races	
	Plus	Minus	Plus	Minus	Plus	Minus
200-204	0	.0006	.0002	.0004	0	.002
300-303	0	.0006	.0002	.0004	0	.002
205-216	0	.0008	.0002	.0006	0	.002
304-313	0	.0008	.0002	.0006	0	.002
403-411	0	.0008	.0002	.0006	0	.002
217-222	0	.0012	.0002	.0007	0	.002
314-322	0	.0012	.0002	.0007	0	.002
412-420	0	.0012	.0002	.0007	0	.002

All dimensions are given in inches.

Table Showing Standard Tolerances for the Outside Diameter, Inside Diameter and Width of Radial Ball Bearings as Adopted by the S. A. E.

In regard to defects in material of races and rolling members, such defects are mostly due to improper treatment during the process of hardening, as most bearing manufacturers inspect the material before it enters the work shop. If the material is over heated it will become brittle and lose more or less of its elasticity, and consequently will easily crack when subjected to shocks or heavy loads. Such material will also soon break or scale off, affecting the race ways and rolling members, and thus making the bearing unfit for further service. Under-heated material will be soft and when subjected to heavy loads will be excessively deformed, even beyond its elasticity, thus increasing the friction and also causing quick wear. It may also occur that the surface of contact of races and rolling members, under influence of the heavy pressure of the load, will become rolled hard, and finally peel off from the softer portions, thus making the races and rolling members rough, which condition finally leads to the destruction of the entire bearing.

Workmanship.

In order to provide for interchange of ball and roller bearings of different makes they must be made to standard sizes in inside diameter, outside diameter and width, and also the tolerances for these three principal dimensions should be as small as possible. Of course it has to be realized that the working to fine limits means a high cost of production, and naturally tolerances and the cost of production have to be held to reasonable limits. The accompanying table shows standard tolerances for the outside diameter, inside diameter and width of radial ball bearings as adopted by the S. A. E., but it may be stated that these figures give the extreme limits to which ball bearings are to be manufactured, and, as a matter of fact, most of the high-class ball bearings are made within considerably smaller limits.

The inner and outer faces of the bearings are ground, and must be absolutely parallel when the bearing is assembled. The sides of the races are also ground, and must be absolutely at right angles with the inner and outer faces in order to secure a proper seat on the shoulders of the shaft and in the housing. Race

ways and rolling members are ground, and should be highly polished, because the smoother the surface the less friction will be produced. The balls or rollers should be absolutely uniform in size and shape. In ball bearings a difference in the size of balls will cause the larger balls, when passing the zone of the highest load pressure, to take more than their share of the load, and then, consequently, will have to withstand a greater deformation than the smaller balls, while the latter in some instances will be compelled to slide. This condition will result in a breaking or flaking off of portions of the race ways and balls. The defect will show up quicker and stronger in bearings operating at higher speeds than in bearings running at slow speeds, as at high speeds the load is applied upon the balls in much quicker succession than at slower speeds, and also because the safe load of a ball decreases as the speed increases. As a matter of fact, steel balls, as used for high-class ball bearings, are guaranteed to be absolutely spherical, and made uniform in size to a tolerance of .0001 inch, which is accomplished by the use of special gauging machines. In order to secure absolute uniformity of size of the balls in a ball bearing, some manufacturers have specially designed gauging machines to select the balls for every individual bearing.

In roller bearings with rollers of unequal size, the large ones will be affected in about the same way as the larger balls in ball bearings, while the smaller rollers, running more or less loosely between their races, will lose their alignment and wedge; that is, the rollers will roll obliquely until pressed against the side shoulders of the races, then return suddenly to their normal position, and will roll sideways, etc. This

exactly of the same shape, that is, not exactly cylindrical in straight roller bearings, and not exactly of the same taper in taper roller bearings. It is quite difficult to grind rollers absolutely uniform in size and shape, and, therefore, in regard to safe loads at high speeds, a higher factor of safety should be observed for roller bearings than for ball bearings.

Ball and roller bearings should not be assembled too tightly, as such a condition will put the balls or rollers under a slight pressure before they do any actual service. Assuming that the inner race of the bearing will always be mounted with a tight fit, or even a press fit, on the shaft, and taking into account that the rolling members are assembled tightly between the races, the expansion of the inner race, caused by the press fit on the shaft, will produce a heavy pressure on the rolling members. Consequently all bearings should be assembled with a slight radial shake, which, in most cases, will be eliminated after the bearing is mounted on the shaft.

There are a number of makes of ball and roller bearings on the market, and the manufacturers furnish catalogues and tables showing the dimensions and permissible carrying capacities of the different sizes and types of bearings. All makes of ball bearings are standardized in regard to inside diameter, outside diameter and width, and, therefore, are interchangeable as far as these three dimensions are concerned. This interchangeability is sometimes offset by the difference in carrying capacity between the different makes, due to a difference in the number and size of balls, as—if other things being equal—the product of the square of ball diameter and the number of balls is the principal factor to determine the carrying capacity. Another cause for a decrease in carrying capacity is the use of inferior bearing material. Therefore, when replacing bearings of a certain make with those of another make and of the same size, attention should be paid to the fact that there should be no remarkable difference in the permissible carrying capacity of the two, otherwise, it may easily happen that trouble will result when replaced by a bearing of a lower carrying capacity. This also applies to roller bearings. Then cases occur where bearings, which were originally selected for a certain purpose, will become overloaded on account of changes in load and

Inner Race Diameter in mm.	Bearing Numbers	Addition to Shaft Diameter in Inches	
		Min.	Max.
10 to 20	200 to 204	0	.0003
22 to 40	205 to 208	0	.0004
45 to 75	209 to 215	0	.0006
80 to 110	216 to 222	0	.0008

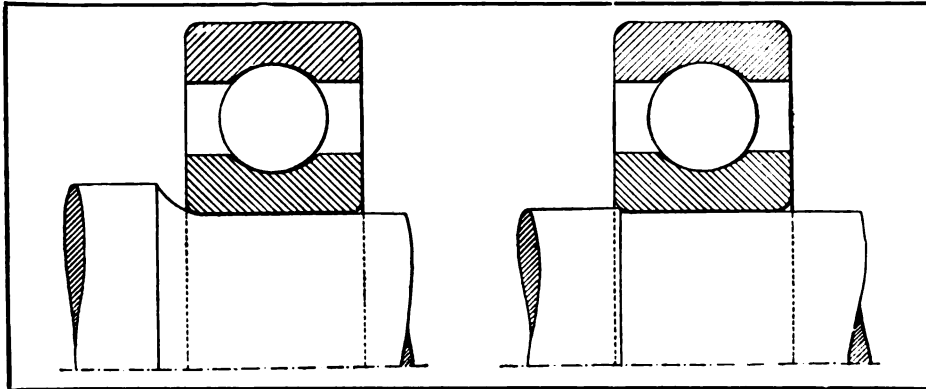
Table Affording an Idea as to What Limits the Bearing Seat on the Shaft Should Be Ground.

wedging of the rollers will produce a considerable amount of end thrust and friction, which will cause quick wear of the rollers and races. The same wedging will occur in case the rollers are not

speed due to a change in the gear ratios or the arrangement of the power transmitting gears, or also a change in the distances between the bearings and the power or load transmitting points. Other

overloads upon the bearings may be produced by increasing the amount of the driving power or the speed of the driving shaft without changing the other parts of the machine. All such changes

ing makers for the outer race diameter, it is quite difficult to recommend positive figures from which to obtain a proper sliding fit for the outer race in its housing for all makes of ball bear-



If the Radius of the Fillet on the Shaft is Larger Than the Radius of the Chamfer on the Bearing Race, the Latter Will Not Contact with the Shoulder on the Shaft (Left), If the Shoulders on the Shaft Are Too Small, the Inner Bearing Race Will Be Forced to Slip Over (Right).

should be carefully considered and taken up with the bearing maker.

Mounting of Bearings.

It is a well known rule in the practise of mounting radial ball bearings that the inner race should have a tight fit on the shaft, while the outer race should be placed in the housing with a sliding or sucking fit. The principal reason for this rule is that in most cases the inner race is rotating while the outer one is stationary in its housing. Therefore, a tight fit will prevent a movement between the inner race and the shaft, while the sliding or sucking fit of the outer race will allow the same to creep slowly, and bring different parts of it under the zone of the load. A press fit always results in expansion of the inner race, and there is always some doubt as to what extent the inner race can be expanded without cracking it, or straining the material too much, decreasing the carrying capacity, or, a very vital point, pressing the balls tightly between the race ways. Such pressure on the balls results in an elastic deformation of them, and is very likely to expand the outer race also. A ball bearing operating under such conditions will be noisy and wear out quickly. Practical experience has taught that the press fit, or, in other words, the expansion of the inner race, should not exceed .0005 inch to .001 inch, according to the size of the bearing.

Assuming that most ball bearings are ground in the bore from a standard to a minus limit of .0004 inch, the accompanying table will give an idea as to what limits the bearing seat on the shaft should be ground.

The outer race should never have a press fit in the housing, but it is just as bad to go to the other extreme and have the fit too loose. As agreed to by the ball bearing manufacturers, the outside diameter of ball bearings is ground from standard to a minus limit. Accordingly the outer race diameter will always be a few ten-thousandths under standard, but never above standard. But since there is considerable difference in the limits actually used by the different ball bear-

ings. The best way, naturally, would be to fit every individual ball bearing in its housing, but in order to insure interchangeability, a sufficiently loose fit will be obtained if the bore in the housing be made from .0003 inch to .0006 inch larger than the standard outside diameter of the bearing.

The same mounting rule applies to roller bearings, but as the tolerances actually used for inside and outside diameter are not standardized, but vary to a great extent for the different makes, it is impossible to recommend comprehensive figures for securing a proper seat of the races on the shaft and in the housing.

If a ball or roller bearing is to be mounted in a soft metal housing, for instance, aluminum alloy, it is good practise to force a bushing of bronze or steel into the housing, and to mount the bearing with a sucking fit into this bushing. This method secures a proper seat for the bearing, as it can creep inside the bushing without working itself loose, which would be the case if the bearing were placed in the soft metal housing.

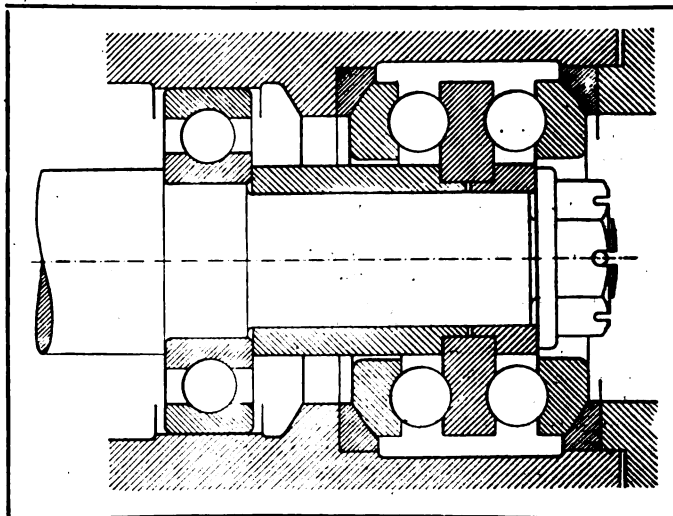
In order to obtain a full seat of the bearing, which is essential for the proper application and distribution of the load pressure, the bearing seat on the shaft and in the housing must be absolutely cylindrical, that is, it must not be tapered or oval. If the area of contact between the inner race and the shaft, or between the outer race and the housing, is insufficient, it will happen that the pressure per unit area upon the material of the shaft and housing will

become too large, in which case the material of the shaft will be depressed and the bearing will become loose. Cases are known where the inner race of heavy duty bearings were mounted on a shaft made of soft steel, and the inner race of the bearing pressed itself into the shaft on account of the excessive load per unit area of contact. By slow creeping of the inner race on the shaft the material of the shaft was worn off in a short time under influence of the heavy pressure. Loose bearings result in loose shafts, and a loose shaft will set up vibration, which will seriously affect the operation of the gears.

If the shaft is mounted on two or more bearings, care should be taken that it and the bearing housings are in alignment, otherwise angular pressure will be produced, which probably will cause an overload and quick wear of the races.

In case the bearing is mounted against a shoulder on the shaft or in the housing, such shoulders should be sufficiently high to give good support to the bearing. If, for instance, the shoulders on the shaft are too small, the inner race of the bearing when pressed against the shoulder will be forced to slip over it, thus expanding the inner race and producing angular pressure on the balls. The fillet left at the point where the shaft is decreased in diameter should have the same, or a smaller radius, than the standardized radius of the chamfer of the bearing races. If the radius of the fillet is larger than that of the chamfer on the bearing race, the latter will not come in contact with the shoulder on shaft, but probably will be expanded.

Each bearing, before mounting it, should be thoroughly washed out in clean gasoline in order to remove any foreign matter. Care should also be taken that the inside of the housings and the shaft are absolutely clean. In case a



If a Double-Acting Thrust Ball Bearing Is Located on the Same Shaft with Radial Ball Bearings and All Are Mounted in the Same Housing, or in Housings Which Cannot Adjust Themselves to the Bearings, One Race Each of the Radial Bearings Must Be Laterally Free, so That the Entire Axial Load Can Be Received by the Thrust Bearing.

press fit is recommended for the inner race, the bearing should be placed in a thin oil free from acid and heated to about 110 degrees Fahrenheit for about five minutes, thereby slightly expanding

the inner race and thus facilitating the mounting on the shaft. After the bearing has cooled, it may be placed into its housing.

When mounting the inner race on the shaft, care should be taken to avoid striking hammer blows against the outer race or against the ball retainer, as this treatment is liable to damage the race ways, balls and retainer. The best and simplest way for driving the inner race on the shaft is to use a tube with a piece of wood laid across the free end. Light hammer blows upon the wood will produce an all around equal pressure against the inner race.

There are a number of different locking devices recommended and used for the fastening of the inner race on the shaft and the outer race in the housing, but as their construction largely depends on the space available for them, it would lead too far to go into details here.

Protecting the Bearings.

Ball and roller bearings must be carefully protected from water, acids, alkalis and abrasives, as every one of these substances will shorten the life of the bearings. To prevent such foreign matter from entering the bearing from the outside, the housings must be closed tightly. The usual manner of packing bearing housings consists of providing grooves in the housing or housing lid at the places where the shaft passes through and pressing gaskets made of felt or the like into them or filling them up with a stiff grease. In bearing housings exposed to water or dust, it is advisable to arrange two or more of these grooves alongside of each other or to use an additional packing in the form of a leather washer, which when slipped tightly over the shaft, is pressed against the housing. Where the construction of the housing does not allow such arrangement, the construction of the packing will be determined by the special shape of the housing parts and the space available.

Lubrication and Lubricants.

As bearing failures very often result from improper lubrication or the use of impure lubricants, the question lubrication needs very close attention and consideration. It is an old rule, and it cannot be repeated too often, that ball and roller bearings lubricants must not contain any water, acid, alkali or any kind of abrasive. Such substances, whether they were originally contained in the lubricant as impurities or entered the lubricant later, will greatly affect the highly polished surfaces of races, balls and rollers.

The water will oxidize the steel and create rust, which will produce pits, especially on the high polished raceways and rolling members, while the rust itself will flake off and mix with the lubricant and will act as an abrasive between races, rolling members and cage. Acids and alkalis will cause an etching of the polished surfaces, making them uneven and rough, and consequently the bearing will wear and will soon be unfit for further service. Abrasives, such as sand, dirt, emery or carborundum, metal flakes, filings, etc., when mixed with the lubricant, will be carried to the surfaces of contact between the races, rolling members and cage, and at these places will have a grinding effect, thus causing quick wear.

There are a number of possibilities for such abrasives getting into the lubricant. Housing castings for transmission and differential gear cases, if not carefully cleaned, may have sand sticking to the inside corners, which will loosen and mix with the lubricant. If the housings are not tight, all kinds of dirt in the form of dust will enter, and the lubricant will

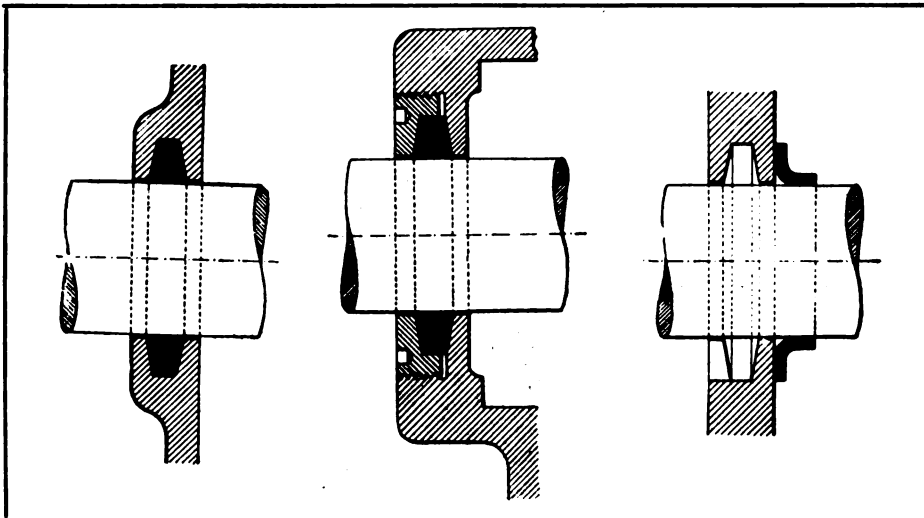
to lubricate the bearings, and, therefore, such lubricants known on the market under the general name of automobile lubricants will have to be considered.

Animal and vegetable fats and oils contain fatty acids which may become free as a result of age and high temperature and are then in a condition to corrode metals. Many vegetable oils become gummy and thicken, thereby losing their lubricating properties.

Pure mineral oils and mineral oil greases have been found most suitable for ball and roller bearing or automobile lubricant, but their qualification for this purpose depends not only on the quality of the oils, but also on the method of compounding. As it is seldom possible for the user to determine these points, he must rely largely upon the reputation of the manufacturers.

Speaking especially of lubrication for ball and roller bearings, it is usually recommended to use oil for high speeds and to use grease for slow speeds and heavy loads. Considering the extremely small area of contact between balls or rollers and races, and consequently the

extremely high pressure per unit area, it is very difficult, and in bearings for very heavy loads, almost impossible, to provide a permanent film of oil or grease between the surfaces of contact in order to prevent a metal to metal contact. The best way to overcome these difficulties seems to lie in the use of oils and greases mixed with graphite. In these compounds the oils or greases serve more or less as a vehicle which carries the graphite to the surface of contact. The graph-



Usual Method of Packing Bearing Housings (Left and Right), If the Housing Is Exposed to Water or Dust, It Is Many Times Advisable to Use a Leather Washer, Which When Slipped Tightly Over the Shaft Presses Itself Into the Housing (Right).

ite used must be extremely fine and pure and prepared by the manufacturer with this particular use in view. Experiments have proven that a selected variety of finely ground flake graphite is the best suited for this purpose. Because of its form it adheres firmly to the bearing surfaces, and because of its toughness it forms an enduring film.

Another vital point to be considered in ball and roller bearing or automobile lubrication, is that some lubricants which may serve splendidly at a normal temperature will lose their lubricating quality at high temperatures or become stiff at very low temperatures; for instance, it has been determined that some automobile lubricants of a certain grade were satisfactory in summer time, while they absolutely failed in the winter time in cold parts of the country. Therefore, all oils or grease should be guaranteed not to change their composition or viscosity at extreme temperatures.

When speaking about lubricants for bearings in automobiles, motor trucks or other kinds of power driven vehicles, it is a matter of fact that the same lubricant which is used for the gears, motor and other parts of the car will also have

SUGGESTIONS FOR THE FORD CAR OWNER.

Removing the Crankshaft from the Engine Block, Determining the Condition of the Main and Connecting Rod Bearings and the Needs for Restoration.

The 47th article dealing with the operation, construction, maintenance, care and repair of the model T Ford chassis is the eighth of the series devoted to adjustment, restoration and overhauling.

REMOVAL of the crankshaft from the engine block is the next operation. This is following the assumption that the entire power plant is to be dismantled and examined, so that replacement, in the event of extreme wear, or adjustment, can be made. As has been stated, the crankshaft of the Ford engine is a steel drop forging, formed with the flywheel flange integral, and this is ground to size in seven different places, these being the three bearing pins and the four crank pins and having four short and two long webs or cheeks, between which are the crank pins on which the big ends of the connections are carried.

The main bearings are 1 15/16, 2 1/8 and 3 1/8 inches length in the order from front to rear, this

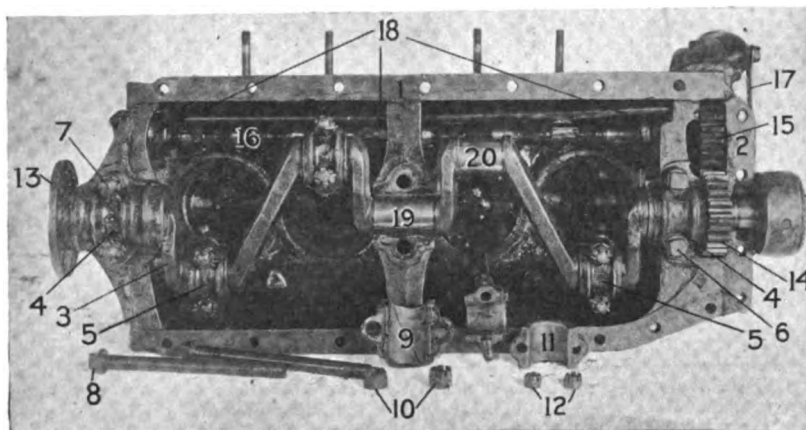
When the engine block is built at the Ford factory the molten babbitt metal is poured into the bearing recesses with jigs or fixtures for doing this work quickly and accurately. The castings are heated to a temperature so that there shall be no shrinkage and when the block and the bearing linings cool the cast iron and the bearing metal are perfectly in contact and the linings are firmly held. The bearing caps are steel drop forgings and these are formed in the forging with holes in them in several places. The caps are lined with babbitt metal in much the same way as the lining is placed in the engine block.

The caps are placed in fixtures and are heated, and the molten babbitt metal poured into them. The holes in the caps have larger diameters outside than inside, and when the babbitt metal cools the linings are anchored into the caps by the little stubs or bosses that project into and fill the holes in the caps. The babbitt linings are originally cut to exact diameter so that they fit the crankshafts when assembled. In fact, the linings fit so tightly that they must be worn to size, and the crankshafts are turned by power after the engines are assembled until they can be turned by the power of the engines themselves.

The main bearing caps are each secured to the engine block by two long bolts that pass through the casting. The nuts of the bolts of the front and centre main bearings are on the outside of the casting, the former pair ahead of the forward cylinder and the latter pair between the second and third cylinders, and the heads are seated against the bearing caps in the crank chamber, but the rear cap is retained with bolts that

have the nuts seated against the cap and the bolt heads against the rear of the block between the cylinder and the magneto field when the engine is assembled. This construction is so that the crankshaft bearing cap nuts may be tightened without disassembling the entire engine.

The bearing caps are usually fitted with liners or shims, which are thin strips of sheet metal that are between the caps and the engine block, through which the retaining bolts pass. These shims are on either side of the shaft and there is



The Main and Connecting Rod Bearings of the Ford Engine.

- | | |
|--|-------------------------------------|
| 1—Cylinder Block. | 11—Connecting Rod Cap and Bushing. |
| 2—Timing Gearset Cover. | 12—Connecting Rod Cap Nuts. |
| 3—Crankshaft. | 13—Crankshaft Flange. |
| 4—Main Bearing Caps. | 14—Crankshaft Timing Gear. |
| 5—Connecting Rod Caps. | 15—Camshaft Timing Gear. |
| 6—Crankshaft Cap Bolt Heads. | 16—Camshaft. |
| 7—Crankshaft Cap Nuts. | 17—Timer Clamp. |
| 8—Centre Main Bearing Bolts. | 18—Camshaft Bearings. |
| 9—Centre Main Bearing Cap and Bushing. | 19—Centre Main Bearing Cap Removed. |
| 10—Centre Main Bearing Cap Nuts. | 20—Connecting Rod Cap Removed. |

giving a total bearing length of 7 3/16 inches. The main bearings are divided longitudinally at the bottoms of the two end and the centre webs of the engine block, the upper halves of the bearing being cast into the block. The bearings are babbitt metal and these are retained by the formation of the casting, the recesses in which they are seated being formed with the end walls at angles, so that the bottoms of the recesses are wider than the tops or openings. These recesses are slightly more than 1/16 inch depth.

an equal number on each side. The bearing can be made to fit closer by removing the shims a pair at a time (one from either side of a cap) until adjustment is such that there can be no play. The purpose of the shims is to afford quick and easy means of adjustment without refitting the bab-bitt metal of the bearings.

Cap Nuts Should Be Tightly Set.

One will understand that the nuts of the bearing caps ought to be at all times tightly set, and they should be locked with wiring, so that there can be no possibility of the nuts loosening and the bearings becoming slack. When the bearings are well fitted there is no play of the crankshaft in them, and yet the shaft should be free enough to be turned by hand. With use the bab-bitt metal will wear and play will develop. If the engine is operated with the bearings so worn that pressure is not equally distributed, there will be knocking or pounding and the irregular movement will be extended to the connecting rod and to the wristpin bearings in the piston bosses, and there will be side pressure wear on the cylinder walls from the pistons. But because the bearings are softer metal these will wear much more quickly. One very general cause of bearing wear is lack of lubrication. The heat generated by friction quickly becomes intense and the soft babbitt of the connecting rods and the main bearings can become so soft that it may be plastic, or it may be actually melted. The harder bronze of the wristpin bushing in the pistons will endure much greater heat, but it will yield quickly if not lubricated.

The supposition may be that the soft babbitt and bronze are not enduring, but no better combination can be found, not even in the highest priced constructions. The only difference would be in the quality of the metals. No standard of bearing life can be consistently established, but with careful attention to lubrication and adjustment the main bearings of a Ford car will give service for many thousands of miles. The life of the bearings of the large or crankshaft ends of the connecting rods may be said to be approximately half that of the main bearings, because they are comparatively smaller in area and are subjected to relatively higher pressures, or, to put it another way, subject to greater unit stresses.

The Life of the Bearings.

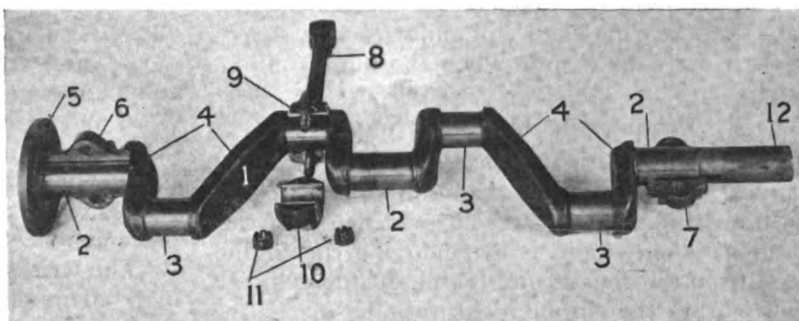
Should the car be driven with ordinary care one might expect that the connecting rod crankshaft bearings should be adjusted at the end of each 5000 miles of driving, and the main bearings at the end of each 10,000 miles. No matter how much care is given or how efficient the lu-

brication, the bearings will wear and eventually will require adjusting.

Because the flywheel and the transmission gearset are enclosed in the engine case when the power plant is in the chassis, one cannot test the condition of the main bearings by movement of the crankshaft. One can, however, by removal of the plate below the cylinders in the lower section of the crank case, reach the connecting rods for determination of the degree of wear. The connecting rod bearings ought to have sufficient end clearance so that they can be moved about 1/16 inch longitudinally along the crankshaft, and this movement should be equal at the small end on the wrist pin, but there should be no clearance between the crankshaft or the wrist-pin and the bearings.

Testing the Connecting Rods.

The condition of the connecting rod bearings can be learned by grasping the rods and endeavoring to move them up and down in the cylinders, and if play exists this can be compensated by cutting the lock wiring of the castellated con-



Crankshaft Removed from the Engine Block.

- | | |
|---------------------------------|----------------------------------|
| 1—Crankshaft. | 7—Front Main Bearing Cap. |
| 2—Crankshaft Main Bearing Pins. | 8—Connecting Rod. |
| 3—Crankpins. | 9—Connecting Rod Bolts Cap. |
| 4—Crankshaft Webs or Cheeks. | 10—Connecting Rod Cap. |
| 5—Flywheel Flange. | 11—Connecting Rod Cap Nuts. |
| 6—Rear Main Bearing Cap. | 12—Crankshaft Starting Pin Hole. |

necting rod cap bolt nuts, loosening and removing the nuts and taking one or more shims from each side of the cap. One may find that the bearings are worn differently, so that the number of shims necessary for restoration of adjusting will differ with each bearing.

While the connecting rods can be worked on without much difficulty when the crank case plate has been taken off, because the caps are very nearly as low as the edge of the crank case housing, the main bearings can only be reached for testing the condition of the nuts of the bolts retaining the caps. The crankshaft bearings cannot be even tested while the engine is in the chassis because one cannot lift the flywheel and transmission gearset. The condition of the crankshaft bearings can be determined, however, at least by an experienced man, by letting the engine idle (run without load), and then accelerating it. There will be a distinct pound when the acceleration is begun. This test is practical and can be made as frequently as desired.

The wristpins are clamped in the small ends of the connecting rods by bolts that are locked by wiring. The rod ends are bored and are split. The wristpins are placed through the bronze bushings of the bosses of the pistons and the eyes of the rods. There are semi-circular slots or grooves in the wristpins, into which the clamping bolts fit, and when the bolts are tightened and the nuts secured the connecting rods prevent the ends of the wristpins projecting through the bushings of the pistons, so the wristpins cannot contact with the cylinder walls. There should be a transverse movement of approximately $1/16$ inch of the wristpin in the bushings when the adjustment is correctly made.

The crankshaft should have no longitudinal movement in the main bearings. The rear main bearing and the cap are so formed that there is a ring of babbitt metal about $3/16$ inch thickness at the rear of the bearing, against which the flange of the crankshaft seats, this being intended to take end thrust and prevent stresses upon the bearings. This ring of babbitt is considerably larger than the diameter of the bore of the crankshaft bearings and will endure a very heavy pressure for a long time when thoroughly lubricated.

Testing the Main Bearings.

One will understand that the only practical manner of testing the condition of the crankshaft bearings, after there is evidence that adjustment is necessary, is by removing the engine block from the chassis and taking off the cylinder head so that the engine block may be placed inverted, as is shown in the illustration. Then by raising the flywheel with blocking and a small bar, or by lifting, one can determine the degree of wear. The reason for raising the flywheel is to remove the weight from shaft end, which might prevent one learning very accurately the state of the bearings.

The main bearings of the older types of Ford engines were differently constructed, the upper halves being formed by machining three semi-circular recesses in the engine block, while the lower halves are babbitt lined caps, such as have been described. These bearings gave excellent service, and had the advantage of there being but half of the bearing that might be affected by heating.

Rather strangely, when main bearings become so heated as to be plastic, the weight of the crankshaft and the pressure of the pistons upon them cause the shaft to settle and a thin skin or film of metal is carried from the lower halves to the upper, roughening the lower surface more or less and forming what may be likened to ridges and grooves that seemingly follow the direction of revolution of the shaft.

Where Wear Is Most Manifested.

In a general sense the same result obtains with the bearings of the big ends of the connect-

ing rods, the metal being softened by friction, but there is evidently a greater degree of wear, for, despite the lubrication, the life of the main bearings may be regarded as twice that of the connecting rod bearings. Considering the manner of wear of the main bearings, the rear will wear the most, the front the least, and the centre somewhere between the two. The average mechanic might be inclined to attribute this to inefficient lubrication, but as a matter of fact the greatest supply of oil is fed to the rear bearing and the least to the front bearing, with the centre bearing receiving about the proportion that is indicated by the degree of wear.

This variance of wear is due without question to the stresses of the transmission gearset at the rear end of the shaft, which is not noticeable while the engine is operating, because the gearset is enclosed, but the stresses of the service brake, as well as those resulting from work in low gear ratio and reverse cause side pressure on the bearings that will gradually increase the diameter of the bore of the bearings, until a decided pound will be heard when the test stated above is made. This pounding will probably indicate, and no doubt be so understood, that the connecting rod bearings are correspondingly worn and that both the main and connecting rod bearings require attention. Not only this, if the bearings are not restored, there will be wear of the piston wristpin bearings, which will mean replacement.

The wristpins are $3\frac{1}{2}$ inches length and $47/64$ inch diameter. They are mounted in bronze bushings having $15/16$ inch external diameter and $1\frac{7}{32}$ inches length. When the wristpins are fitted there is $1/8$ inch clearance between the ends of the pins and the cylinder walls, because the pins must be centred with reference to the clamping bolts and allowing for $1/16$ inch movement of the pins in the piston bushings, there will be a clearance of $1/16$ inch at one end and $3/16$ at the other. There is no probability of the wristpins touching and scoring the walls of the cylinder block save in the event that a clamping bolt should break and fall and release a pin, which is extremely remote.

(To Be Continued.)

NEW 24-HOUR RECORD.

Ralph Mulford broke all automobile racing records for from one to 24 hours at Sheephead Bay speedway, May 2, when he travelled 1819 and a fraction miles in 24 hours in a Hudson Super Six. The best previous distance made during a 24-hour continuous run was by S. F. Edge nearly nine years ago on the Brooklands track in England, he making 1581 miles. Mulford's trial was sanctioned by the American Automobile Association and was timed by its representative.

Big Automobile Merger Reported and Denied.

Large Automobile and Motor Makers Are Said to Be Planning a Huge Corporation to Rival Steel Trust in Size.

Great publicity has been given in Detroit to plans for a giant merger of great automobile concerns, but some of the men involved have emphatically denied the truth of the reports.

The report was to the effect that a merger was contemplated which would join General Motors, Maxwell, Studebaker, the Continental Motor Company and Chevrolet in a single great organization.

This was to be brought about by W. C. Durant, the Dupont interests, who have been backing him; the Morgan and Standard Oil groups and Lee Higginson & Co. of Boston.

The story has it that conferences have been on in New York for some time and that the scheme is now practically complete. It was said that the control of the General Motors had definitely passed to Chevrolet and the Durant backers.

It was said that W. E. Flanders, who has built up the Maxwell company and controls it, was ready to sell his control and had already taken an option on the Lozier plant in Detroit as the basis for a new venture.

Flanders energetically denies the report, having gone so far as to buy large advertising space in Metropolitan newspapers for that purpose. The Studebaker corporation also disclaims all knowledge of the matter.

Another feature of the story was that the Pennsylvania railroad had secured entry to Detroit and had purchased ground for a large terminal.

PICKENS HEADS METZ SALES.

Roscoe A. Pickens is now managing director of sales for the Metz Company.



Roscoe A. Pickens, Managing Director of Sales for Metz Company.

Waltham, Mass., and his appointment evidences, according to the company's announcement, "the new type of sales service we are delivering." Mr. Pickens joined the Metz organization in September, 1911, and since that time has been in close touch with the sales problems of the company. His experience has included duties in such positions as sales manager, advertising manager and merchandising representative, both in New England and Texas, and he has a wide acquaintance among the country's distributors of motor vehicles and accessories.

RECORD SHIPMENTS IN APRIL.

Report's given at the last meeting of the directors of the National Automobile Chamber of Commerce indicate that during the month of April, lacking the three days for which figures were not available, shipments of motor cars had amounted to 29,000 carloads, which is 400 more than in March, 1916, and 11,000 more than for April of last year. Although the plants were supposed to have reached their capacity in March, this indicates a gradual increase in their producing power.

An improvement in the traffic situation was reported to have resulted from the effort to return empty automobile cars to the automobile factories and to the fact that the car factories are more rapidly turning out the new freight cars which are on order. In the New England territory, however, the New Haven railroad has been forced to restore a number of embargoes.

The chamber expressed its disapproval of the Tavenner bill, prohibiting the use of stop watch efficiency methods in the production of supplies for the government. This is understood to mean that a company selling trucks or cars to the government could not use such methods in its factory. The bill is backed by the labor group in Congress.

The United Motor Fuel Corporation, which is being fathered by S. A. Miles and Alfred Reeves of the chamber, was discussed, and some of the makers declared that the high cost of gasoline was causing some falling off in the sale of the larger cars and adding popularity to the smaller and more economical types.

A. L. Riker, vice president of the Locomobile Company of America, was elected to the board of directors as the representative of his company.

YOUNG WITH ALLEN.

Thomas L. Young, formerly with the Willys-Overland advertising department, is now assistant advertising manager of the Allen Motor Company, Fostoria, O. This acquisition comes at a time when the Allen company reports that within the past 11 months its output has been tripled in volume. It is also announced that the company's entire production has been contracted for and that plans are now being formulated for an increase in production, as well as of advertising.

Exports of Cars Continue to Increase.

Official Figures Show That American Cars and Trucks Are Still Favored Abroad.

Exports of motor cars and trucks for the eight months ending with February, 1916, were four times greater than for the eight months ending February, 1914, before the war began. The figures for 1916 are 14,467 trucks and 33,256 passenger cars, valued at \$64,264,228. For 1914 they were 493 trucks and 16,390 passenger cars, valued at \$15,716,809.

During February the exports of cars and trucks were 2063 trucks, valued at \$6,170,367, and 5651 passenger cars, valued at \$4,063,429. This compares with February, 1915, after the war was well under way, as follows: Trucks, 1002, valued at \$3,022,482, and passenger cars 2230, at \$1,785,330.

TO HANDLE FISK ADVERTISING.

On June 1 George L. Sullivan, who has been associated with Bromfield & Field, Inc., New York City, advertising agency, will become advertising manager of the Fisk Rubber Company, Chicopee Falls, Mass.

Mr. Sullivan has had unusual experience in advertising in all its branches. His initial venture was with the Boston Woven Hose and Rubber Company in the sale of Vim bicycle tires, which he left to become advertising and special sales manager of the Daniels & Fisher Stores, Denver. In the agency field his first connection was with the Cheltenham company, and in the automobile industry with the American Locomotive Company. During the three years he was with the latter company he first was in charge of advertising and later was manager of the branch at Chicago.

As assistants Mr. Sullivan will have Miss M. G. Webber and George B. Hendrick.



George L. Sullivan, Advertising Manager of Fisk Rubber Company.

New Angle to Rim Patent Fight Develops.

Earl G. Baker, President of the Universal Rim Company of Chicago Attacks Perlman Patents.

The patent situation with regard to demountable rims, which was thought settled by the injunction against the Standard Welding Company and the beginning of manufacture by the Perlman Rim Corporation, has been stirred up again by suits brought against the Perlman factories by Earl G. Baker, president of the Universal Rim Company of Chicago, who has 12 patents, most of which are said to antedate the Perlman patents, covering various features for demountable rims.

These patents were issued to Joseph Anglada, Earl Baker and his attorney, Charles G. Hawley. The case is brought in the United States court for the eastern district of Michigan and the defendant is the Jackson Rim Company, Jackson, Mich., which was recently purchased by the Perlman Rim Corporation.

It is also announced that the Standard Welding Company having satisfied itself that negotiations were useless with the Perlman company, has prepared to put on the market a rim of new design which it will seek to have adopted instead of its old rim. The company has been advised that this in no way infringes the Perlman patents and to show its good faith it has submitted drawings of the rim to the Perlman company.

WHITE HEADS DETROIT S. A. E.

D. McCall White, chief engineer of the Cadillac Motor Company, was chosen chairman of the Detroit section of the Society of Automobile Engineers at the annual election of officers. O. E. Hunt, chief of the Packard motor carriage department, was chosen vice chairman; W. C. Rands, president of the Rands Manufacturing Company, treasurer; B. G. Kroether, general sales manager of the Hyatt Roller Bearing Company, secretary, and K. W. Zimmerschied, chief metallurgist of the General Motors Company, member of the national nominating committee.

CHEVROLET WITH CAR MAKER.

Louis Chevrolet, the racing driver, after whom the Chevrolet car was named, has been made designer and chief engineer of the American Motors Corporation, which is financed by a group of eastern capitalists, who will establish a plant at Plainfield, N. J. Production is expected to start about the first of July and it will amount to 3000 cars a year.

The car will be a five-passenger, six-cylinder model, selling under \$1000. A Continental 3½ by 4½ motor will be used. Other features include spiral

bevel drive, 122-inch wheelbase, 32 by four-inch tires, self-starter and electric lighting. The company is capitalized at \$1,250,000 and has issued \$500,000 of common and \$500,000 of preferred stock.

The group behind the company includes, in addition to Chevrolet, W. H. Hoople, president of the Interstate Electric Corporation; J. C. Spiers, formerly general manager of the Autocar company and factory manager for Locomobile, Mercer and S. G. V. and Standard Roller Bearing companies; G. F. Baright, former advertising manager of the Prudential Life Insurance Company of Newark.

VAN SICKLEN WITH DUNLAP-WARD.

Fred W. Van Sicklen, formerly associated with the Detroit office of the Taylor-Critchfield-Clague Company, is now identified with the Dunlap-Ward Advertising Company as vice president and general representative. Mr. Van Sicklen has been connected with the automobile industry since its inception and



Fred W. Van Sicklen, Vice President of Dunlap-Ward Advertising Company.

enjoys a wide acquaintance among the manufacturers of motor cars and accessories. In his new capacity he will make his headquarters at Chicago.

HUPP EARNINGS INCREASE.

Net earnings for March of the Hupp Motor Car Corporation were \$73,556, which is an increase of \$18,461 over February and \$49,169 over January. Earnings for the month are at the annual rate, which would amount to more than eight times the corporation's requirements for dividends on preferred stock and after payment of regular preferred dividend to over 15 per cent. on common stock. Net earnings for the quarter ended March 31 totalled \$153,038, compared with \$84,012 a year ago.

BIG SPARK PLUG ORDER.

The Beckley-Ralston Company, Chicago, one of the largest automobile jobbers in the country, recently placed an order for 300,000 A. C. spark plugs to be shipped as fast as they could be delivered. This plug is used as equipment by 59 of the best automobile, truck and motor manufacturers in the United States.

Locomobile Profits Show Improvement.

Company Reports in Annual Statement of Finances a Large Increase in Surplus.

The annual statement of the Locomobile Company of America shows an increase of \$500,000 in the surplus. The profit and loss surplus is shown to be \$1,307,589, as compared with \$841,886 last year. Over \$400,000 has been put into new machinery last year and this account now totals \$2,452,697. Cash and debts receivable have decreased by about \$200,000, and patents, trade marks and good will are now held at \$5,515,952, which is about \$200,000 less than last year. The following is the report which has been filed in Massachusetts, where the company is incorporated:

Assets.		
	1916	1915
Real estate	\$186,500	\$186,500
Machinery	2,452,697	2,029,527
Merchandise, material, stock in process	4,148,055	4,235,684
Cash and debts receivable	830,554	1,049,014
Patent rights, trade marks and good will	5,515,952	5,310,793
Sundries	206,921	203,511
Total	\$13,340,681	\$13,015,031
Liabilities.		
Capital stock	\$6,250,800	\$6,250,800
Accounts payable	317,673	397,426
Funded debt	2,018,500	1,176,000
Floating debt	2,775,681	2,789,448
Reserves	670,437	559,469
Profit and loss surplus	1,307,589	841,886
Total	\$13,340,681	\$13,015,031

VIM SALES MAKE BIG INCREASE.

Sales during March for Vim trucks are reported to have been 702 per cent. ahead of the same month last year, according to the company's announcement from the Philadelphia headquarters. For April, in the latter part of the month, the increase was running at 722 per cent. The company has enough shipping orders to keep it busy until the middle of July and contracts on its books call for its capacity up to the middle of next January.

MAXWELL SELLS PARTS PLANT.

The Newcastle plant of the Maxwell Motor Car Company has been sold to the Standard Motor Parts Company, which will hereafter supply the repair parts for Stoddard-Dayton, Brush, Columbia and Alden-Sampson cars, manufactured by the United States Motor Company, which the Maxwell succeeded.

At first the Maxwell company handled the parts business at its various plants and then concentrated it all at Newcastle. The sale of the plant cuts the tie between the Maxwell company and its predecessor, leaving the new corporation free to concentrate on the manufacture of new cars and parts for the Maxwell line.

SHEEPSHEAD BAY READY FOR RACE.

Big New York Speedway's Opening Will Be Featured by the Metropolitan Trophy Race.

The big feature of the races scheduled at Sheepshead Bay, May 13, is the Metropolitan trophy, and for this event 21 entrants have already been secured. The largest number that can compete is 31 and it is probable that nearly that many will be on the track when the race starts.

There will be four short distance events of which the Metropolitan trophy is the chief. In this contest the drivers will race for 150 miles and the purse will be \$15,000. The Queens cup is a 50-mile event with prizes of \$2500. The Coney Island cup is 20 miles and there is a consolation race with \$900 in prizes for the drivers who do not place in any of the first three events.

Josef Christaens, the Belgian army aviator, is one of the latest entrants. He secured a release for a few months from his military duties and will drive a new Sunbeam six developed during the war by Louis Coatalen, the Sunbeam chief engineer, who has incorporated in it, the results of his exceptional experience in building aeroplane motors since the war began. This will be the first race for the car. It is said to have been tried out on the Brooklands track and to have made 116 miles per hour there. If the current belief that the Sheepshead Bay track is the fastest in the world is well founded, that may mean a speed around 130 miles per hour on that track. Aldo Franchi will drive another Sunbeam.

The French makers will be represented by four Delages and a Peugeot. Two of the Delages were run in the Grand Prix at Lyons, France, and will be entered by Harry S. Harkness. Carl Limberg, Jack Le Cain and two drivers not yet named will handle the other Delage cars.

A Peugeot will be driven by Ralph Mulford and Resta will again race in a car of that make.

Grover Bergdoll, the millionaire Philadelphia brewer, and Eugene Stecher will drive a team of Erwins. Billy Chandler and Dave Lewis have entered and will drive new cars known as Crawfords. The Deussenberg team has been entered.

T. E. Myers, general manager of the Indianapolis speedway, has entered three cars. One is a Peugeot, driven by John Aiken, and two are Maxwells. All are under the management of the Prest-O-Lite racing team. The Maxwells will be driven by Pete Henderson and Eddie Rickenbacher. W. T. Muller will drive a Mulford Special, C. W. Thompson a Olsen and Bert Watson a J. J. Special.

The fact that the Indianapolis speedway has entered cars in New York and that the New York cars owned by Harry S. Harkness will compete at Indianapolis, indicates that the various speedways are going to abide by their plans of having their own racers and entering them in events on each other's tracks.

This will lead to a competition somewhat similar to the baseball teams and

after it is fully developed may bring about a final grand championship race similar to the world's series in the baseball field.

BOSCH RACING TROPHY.

An agreement has been made by the American Automobile Association and the Bosch Magneto Company whereby the latter will award a large silver trophy cup and three large cash prizes to the champion racing drivers of the 1916 speedway season in events sanctioned by the A. A. A.

The winner of the trophy will be designated by the contest board of the A. A. A. according to a point system, which will be established for the purpose. It will be contested for in races to be known as championship award events.

These events will be picked by Richard Kennerdell, chairman of the A. A. A., upon receipt and approval of the application blanks. The number of points given for places will be different in various events, according to their importance—the distance driven, the number of starters and similar conditions will be considered.

The driver who makes the highest number of points during the season will be given the trophy and \$2000 in cash, the second highest number of points will win \$1000 in cash, and the third highest \$500 in cash. Every driver will have a chance at these prizes, even though he may win no races, as a high average throughout the season will count more than one or two sensational successes.

During the past few years the Bosch Magneto Company has greatly stimulated motor car racing by giving \$25,000 in special prizes for various events. These new prizes will be won outright and will become the permanent property of the winner.

The cup to be given will be nearly 30 inches high, after the style of the Vanderbilt cup, Grand Prize and Elgin trophy. It will be of solid silver and cost \$1000. A banquet will be held during the Chicago show in January, 1917, at which the trophy will be presented.

The Championship Driver trophy is the third of a series of Bosch trophies that are now given every year. One is a motorcycle trophy for the amateur championship, which has been in existence since 1911. There is also the One-Mile International Record trophy, which goes to the motor boat owner making the fastest sea mile under the Admiralty rules—that is the fastest of six miles driven three one way and three the other.

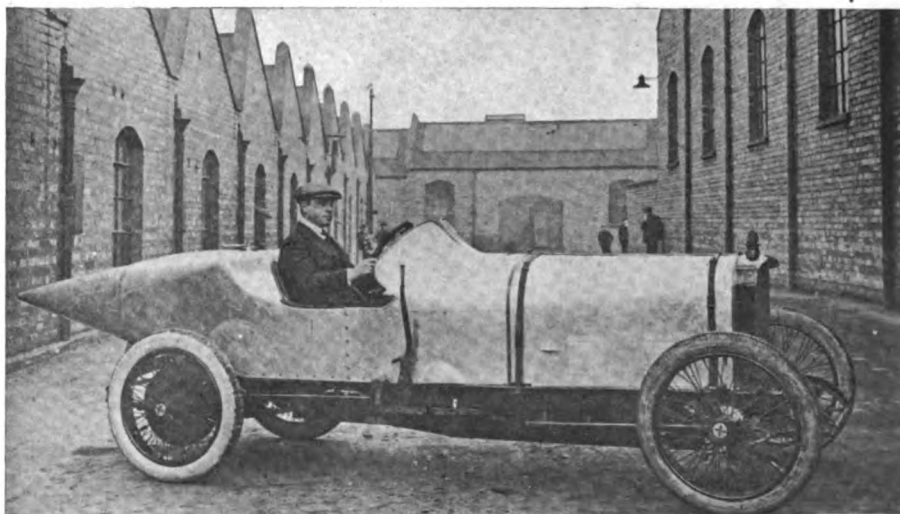
LAW AGAINST TIPPING.

The Automobile Trades Association of New Jersey had passed through the last session of the legislature an act making it a misdemeanor to "pad" patrons' bills or to offer a chauffeur any bonus for trading at a garage. The same law applies to chauffeurs who apply for bonuses. The penalty is \$200 fine or six months' imprisonment, or both. Now that the law is on the statutes, the association has offered a reward of \$100 for information leading to arrests and convictions.

TOURING ON "THE FOURTH."

Following the plan which was used successfully last year, the American Automobile Association and the National Automobile Chamber of Commerce will urge clubs and motorists generally to take to the road in the week which includes the Fourth of July.

At a recent meeting of the executive board of the A. A. A. it accepted the suggestion of the Ohio Automobile Association that the plan be repeated in the belief that the use of 2,500,000 cars on the road will again demonstrate in a most striking way the wonderful ability of the self-propelled vehicle in covering distance and in making the people of different counties and states acquainted with each other.



Josef Christaens, the Belgian Driver, in the English Sunbeam Which He Will Drive at Sheepshead Bay and at Indianapolis on Memorial Day.

INDUSTRIAL NOTES AND COMMENT.

Recent Happenings Among the Makers of Cars and Equipment and Members of Related Industries.

One of the most recent and distinctive motor vehicle display rooms to be opened along New York City's Automobile Row are those of the Manhattan Motors Corporation at Broadway and 56th street. This company distributes Vim delivery cars, and one feature of the display on opening day was the grouping of the five cars that are always carried for exhibition purposes. In laying out the show rooms the architect evolved a quiet elegance which is said to be unsurpassed by any rooms of similar type in this country. The company is headed by E. F. Miltenberger, who is prominent in the motor vehicle industry and will be remembered in connection with the Packard Motor Corporation.

Hyatt Managers to Meet.

The managers of the service branches of the Hyatt Roller Bearing Company will assemble at the general sales office at Detroit, May 18-20, for their first annual convention. The business sessions will be devoted to talks by the officers of the company and to conferences on engineering, sales and advertising matters. The cities that will be represented are Atlanta, Chicago, San Francisco, Los Angeles, Seattle, Boston, New York, Minneapolis and Detroit. It is expected that the convention will be an annual event in the future.

Hill Pump Valve Moves.

The Hill Pump Valve Company, manufacturer of Utility wrenches, pumps and heaters, has just moved into its new factory at Archer avenue, Canal and 23rd streets, Chicago, where there is more than 14,000 square feet of floor space. This is the third time that the company has been compelled by the rapid growth of its business to locate in larger quarters. It is expected that even more space than is now available will have to be obtained in the near future.

Inter-State's Second Drive Away.

On April 27 the Inter-State Motor Company, Muncie, Ind., held its second drive away event. The first took place about a month ago. The visiting dealers came from all parts of Illinois and were headed by Rudolph Isch, Peoria and Chicago, who staged the affair. At the banquet given the visitors at a local hotel, F. C. Ball, president of the Inter-State company, summed up the present situation of the automobile industry with the statement that it will not be a question of selling cars this year, but of getting them, on account of the scarcity of manufactured material. He likened the situation to that which exists in practically all industries.

Puritan Gets Another "Orphan."

The Puritan Machine Company, Detroit, announces the recent acquisition of the parts, blue prints, drawings, jigs, dies, tools, etc., of the Keeton Motors, Ltd., Brantford, Ontario, Canada, and that it will continue service to owners of Keeton cars from the Puritan plant in Detroit. This purchase brings the total of "orphan" motor car companies absorbed by the Puritan company up to 101 in number. It is understood that this Detroit concern is now negotiating with a large eastern company for the purchase of one of the largest companies yet secured.

Reeps Company Organized.

The Reeps Manufacturing Company, which owns the patents and produces Reeps dashboard oil and gasoline gauges for automobiles, Reeps warning signals for bicycles and motorcycles, and several other electrical appliances, was recently incorporated with a capital of \$25,000 and has started operations at 50 Church street, New York City. This company is also in a position to manufacture and make sales arrangements for

automobile and electrical devices or to act as manufacturers' representatives for any similar line. Charles S. Shuman, who has sold Klaxon and Newtone horns for several years, is president and treasurer.

Ahlberg Bearing Again Expands.

The Ahlberg Bearing Company, Chicago, announces the opening of two new factory branches at San Francisco and Portland, Ore., and the installation of an auxiliary regrounding plant at Los Angeles. Ahlberg branches are now located in Boston, New York City, Atlanta, Chicago, St. Louis, Minneapolis, Detroit, Cleveland, San Francisco, Los Angeles and Portland, and are not only distributing offices, but comprise stock rooms. Each branch is in a position to supply immediate replacements on every known type and size of ball bearing and is under direct supervision of the home office at Chicago.

Ford Buys Land in Newark.

Henry Ford recently purchased 80 acres of land at Newark, N. J., at the head of Newark bay and at the confluence of the Hackensack and Passaic rivers. The use to which this tract is to be put has not yet been definitely decided, according to the officers of the company, but it is being held for use in connection with the company's export business in motor cars and farm tractors.

Booklet on Allen Officials.

To give the dealer and the prospect a feeling of the stability as regards the company which produces Allen motor cars, the Allen advertising department has issued a handsomely printed, simple and sensible booklet describing the officials and directors of the company and enumerating their various interests. All are leading bankers and manufacturers in the district about Fostoria, O., except three who are connected with important interests in Cleveland, Toledo and Chicago.

Overland to Increase Pay.

Announcement has been made that on June 1 an increase in wages will be made at the Overland factory by which the 17,000 employees will receive from four to 10 per cent. increases in wages. The shops will be operated on the eight-hour basis instead of the 50-hour week, which is now in vogue. Fifty hours pay will be given for 48 hours work. The factory payroll, which is now \$250,000 a week, will accordingly be increased to \$275,000. The distribution of wages for the year will come to about \$14,300,000.

Paige Discusses Credit Plan.

The Paige-Detroit Motor Car Company, which made arrangements some time ago to finance sales of Paige cars on credit through the Bankers' Commercial Corporation of New York, says that official countenance has been given only to the arrangement with that company and that it has no official connection with any other organization which announces that sales of Paige cars on time can be financed through its service.

Jersey City Exhibition.

Jersey City manufacturers are co-operating in an exhibition of goods made in



Group of Inter-State Dealers from Illinois Gathered at the Inter-State Plant at Muncie, Ind., to Take Part in the Second Drive Away Event to Be Held Within 30 Days.

Jersey City, which will be held June 5-10. The exhibits will not be grouped together in one building, but various retail dealers will turn over their stores to the display of the product of some Jersey City maker in their own line.

Holds Acceleration Day.

An acceleration test and mileage trial for Chalmers Six-30 cars was held recently in various parts of the country by Chalmers dealers. The results showed that a total of 14,961 miles had been run in snow and sleet and very bad weather on 670 gallons of gasoline. An average of 6.5 seconds, timed by the observer's stop watch, was required to go through the gears and reach a speed of 25 miles per hour. In the economy test a special tank holding a gallon was lashed to the dash and connected to the carburetor, which had been thoroughly drained.

Scripps-Booth Foreign Trade.

Astonishing progress in foreign trade has been made by the Scripps-Booth company in the first year of its existence. In spite of the war nearly one-third of the output has been shipped abroad, 1000 cars having been sold in England alone. Already the company has representation practically all over the world, from Trondhjem, Norway, to Dunedin, the city furthest south in New Zealand. Other cities where the car has been sold in considerable numbers are Rangoon and Calcutta, India; Tokio and Yokahama, Japan; Buenos Aires, Cape Town, Sydney, Paris, London, Petrograd and Rome.

One Value of Aluminum.

The use of light metals will shortly mark the difference between the modern and the old style motor car, in the opinion of E. E. Allyn, president of the Aluminum Castings Company. The demand at present is not so much for speed as it is for the ability to speed on occasion. Quick acceleration is the chief requirement. The use of aluminum in the Marmon 34 has reduced the weight of the car by 1000 pounds.

Cadillacs Not Sold on Time.

A statement has been issued by the Cadillac Motor Car Company that it has made no arrangements with any financing company by which Cadillac cars will be sold on time and that publicity to that effect is misleading. The company says that so far as it knows none of its dealers have made such arrangements. The company strongly discourages the plan.

ENDURANCE OF A. C. PLUGS.

One important factor contributing to the recent successful run of a Buick small six from Los Angeles to San Francisco, a distance of 457 miles, in the remarkable time of 10 hours and 47 minutes, was the A. C. spark plug equipment used. In a telegram to the Champion Ignition Company, Flint, Mich., the driver of the car reported that the plugs never missed fire, despite the tremendous strain they were subjected to for about 11 continuous hours.

BIG FLORIDA TOURIST SEASON.

This Has Been the Greatest Tourist Season Ever Experienced
by the Popular Winter Resorts.

Railroads operating to Florida declare the present has been the greatest tourist season ever enjoyed by the winter resorts in that state, and the total number of visitors there from outside is placed at 1,000,000. Of these 50,000 are said to have made the trip by motor car. Garages in the state have been so overcrowded that it has been necessary to park cars in the streets and in vacant lots.

Thousands of inquiries have been made of the Dixie Highway Association as to whether the route was in condition for a comfortable trip home, and whether or not next year it would be in such shape that a tour to Florida over it would be practical. The Dixie Highway Association is very anxious to secure the improvement of as much of the route as possible. The present designation of roads will be changed if they are not improved promptly.

OZARK TRAILS CONVENTION.

There is great activity in the good roads movement in Missouri and all phases of it are to be discussed at the convention of the Ozark Trails Association, which will be held at Springfield, Mo., June 27-28. For the past 10 years there has been a law in Missouri permitting counties to vote bond issues for road construction, but only recently have they begun to take advantage of it.

OVERLAND SERVICE SYSTEM.

Eight service stations in addition to the present large building are to be erected and operated in Cleveland for Overland and Willys-Knight cars by Willys-Knight, Inc., 6604-18 Euclid ave-

nue. The stations will cost \$500,000. Two of them, like the present station, will be very large, while the remainder will be smaller. They will be financed by the distributor, but will be operated by sub-dealers. About 150 new service men and salesmen will be taken on. An additional steel and concrete building for similar purposes will be erected behind the present station and fronting on Carnegie avenue, while the Euclid avenue building will be used exclusively for sales purposes.

QUESTION INTER-STATE OWNERS.

To satisfy a prospective buyer regarding the qualities of Inter-State cars, the company recently asked him to write a list of questions the answers to which would enable him to judge the quality of the car and these were then sent to Inter-State owners. These showed an average repair cost of \$2.42 for 3600 miles, including all garage charges, wrecks and special work. Sixty-three per cent. of the owners reported no expenditures at all for repairs and 72 per cent. reported that their bills had not exceeded a dollar. The average gasoline mileage was 17.1, while a large number obtained over 20 miles.

ALPHONSO BUYS WILLYS-KNIGHT.

The second order for a Willys-Knight car has been received by the Willys-Overland Company from the King of Spain. Only a few days elapsed between the arrival of the first car at Madrid and the order for the second. Most of the luxurious cars of Europe, the production of which is now largely interrupted by the war, are of the Knight engine type.



A Demonstration of the Large Carrying Capacity of a National "Highway" Twelve-Cylinder Car—Here Are 24 Passengers, All of Whom Are Over the Legal Age Limit, Although They Are Less Than Normal Size—They Compose a Well-Known Theatrical Troupe of Midgets.

Purchases Rights to New Green Fuel.

Munitions Maker Buys Privilege to Manufacture Chemical Compound Developed by German Chemist.

It has been announced by B. F. Taylor, treasurer of the Maxim Munitions Corporation, that his company had bought the manufacturing rights to the green chemical compound discovered by Dr. Louis Enricht, which, when mixed with water, is said to answer the purpose of fuel in running an internal combustion engine.

A substantial advance payment has been made to the chemist and he is to have a royalty on the maker's profits. The inventor is expected to receive about \$1,000,000 out of the deal.

Already he is said to have given architects orders for a new home on Long Island and work has been begun on a large laboratory building near his house, where his fuel will be compounded. Application for a patent has been filed and work will go ahead rapidly toward putting the mysterious new fuel on the market.

ARGO RAISES ITS PRICES.

An increase in the price of the roadster from \$385 to \$405 and in the touring car from \$435 to \$455, has been announced by the Argo Motor Company, Inc., which has just been taken over by new interests. High materials costs are said to be responsible. The factory has been operating 22 hours a day for several weeks in an effort to keep up with demand.

SCHWARTZ LEAVES METZ.

William H. Schwartz, for the past seven years general sales manager of the Metz Company, Waltham, Mass., has resigned to enter business for himself.

He has had full charge of Metz sales throughout the country, and this car is now one of the leading popular makes and is well known in foreign countries. Previous to his connection with the Metz company, Mr. Schwartz was associated with the Waltham Manufacturing Company when Orient cars were on the market. He has also been connected with Michigan manufacturing enterprises and is very well known in all parts of the country as one of the leading automobile salesmen.

NEW ELECTRIC SYSTEM BOOK.

A subject that has become of much importance of late years for garage men, service men, dealers and owners, is treated in a new book, "Automobile Ignition, Starting, Lighting," which has been published by the American Technical Society of Chicago. It is written by Charles B. Hayward, member of the Society of Automobile Engineers, of which he was formerly secretary.

The work covers the fundamental principles employed in electrical systems and discusses each of the well known American kinds in detail. It is illustrated with drawings of wiring diagrams as used on the various cars and with many half-tone plates showing the parts that enter into the various constructions.

It is divided into a section devoted to elementary principles, which discusses the electric circuit, magnetism and induction in generators and motors. There is another section devoted to all the different kinds and phases of ignition and the principles which underlie them. Electric starting and lighting systems are treated in the same way with a discussion of general principles and a detailed description of the various systems that are in use.

The book is handsomely bound in soft leather covers and is well printed on good paper. It is a thoroughly high-grade work, interesting alike to engineers and lay men.

Car Maker Condemns Time Payment Plan.

Says Course Is Sure to End in Disaster for Industry, as Well as for Individuals Participating.

Following the lead of the Buick and Cadillac companies, the Olds Motor Works announces its opposition to the widely advertised time payment plans. Jay V. Hall declares that no man should buy a motor car who cannot afford it and any other course is sure to end in disaster not only for the individual, but for the industry as well. To date, he says, the growth of the industry has been entirely sound and at the expense of no other industry at all. This would be changed if men were persuaded to assume obligations they have no business to carry. The dealer would be the man to suffer in most instances. If there were a period of financial stringency among his trade he would have a quantity of half sold cars on his hands, which would have only a second hand value, and have little cash and no bank credit. For 17 years the Olds Motor Works has marketed its cars without a deferred payment plan and it resents the linking of its name with the scheme now.

1916 MODEL TOURING MAPS.

Touring maps that are comprehensive, "up to the minute" and arranged to afford the largest measure of convenience to the users are now being distributed free of charge to inquirers by the Gulf Refining Company, Pittsburg, Penn., or can be obtained from the local dealer who displays the Sign of the Orange Disc, the trade mark of the Gulf Refining Company.

These maps are arranged by states and sections, covering New England, New York State, Pennsylvania, New Jersey, the Southern States, the Middle West and Texas and the Transcontinental routes. They are of a size most convenient for the pocket or touring book holder and are very legible. The best roads for travel are shown on the maps in red, while others not so good are indicated by the conventional parallel line arrangement. Each road is keyed with a number for reference to the Automobile Blue Book.

BOSCH SECURES CONTRACTS.

The Bosch Magneto Company announces that it has made contracts with the following firms of motor car and motor truck makers for the use of Bosch magnetos during the coming season: Roberts Motor Manufacturing Company, Sandusky, O.; Henderson Brothers, North Cambridge, Mass.; Jordan Motor Car Company, Cleveland, O.; Republic Motor Truck Company, Alma, Mich.; Nordyke & Marmon, Indianapolis, Ind.; Ogden Motor Works, Chicago. The last two will use Bosch starting and lighting apparatus as well as ignition.



These Four Overland Model 86 Cars Are Used as Stage Coaches on the Apache Trail in Arizona on a Route 120 Miles Long, the Running Time Being Eight Hours—They Frequently Make 720 Miles in Three Days in Emergencies and Have Attained as High as 16 Miles to a Gallon of Gasoline, Which Is Extraordinarily High Under Conditions of Travel There.



AS ONE watches motor cars weaving through the congested traffic of a city's streets, stopping instantly when collisions seem imminent and continuing when there is a clear passage, he is impressed by the absolute control of the driver of the powerful car he guides so easily. It is a striking demonstration of man's mastery over a complicated mechanism that is vastly more powerful than the strongest human being.

The impression becomes more profound when one considers that this control is largely possible through the operation of a comparatively narrow band of fabric which has been spun and woven out of rock mineral. The conception of the importance of this band, the brake lining, in the operation of motor vehicles, grows in proportion as one realizes that it is the one safeguard against accident and disaster when traversing the highways of the country, particularly on steep hills and at cross roads.

One may conjecture a car load of tourists rushing down a steep grade at the maximum rate permissible by the law.

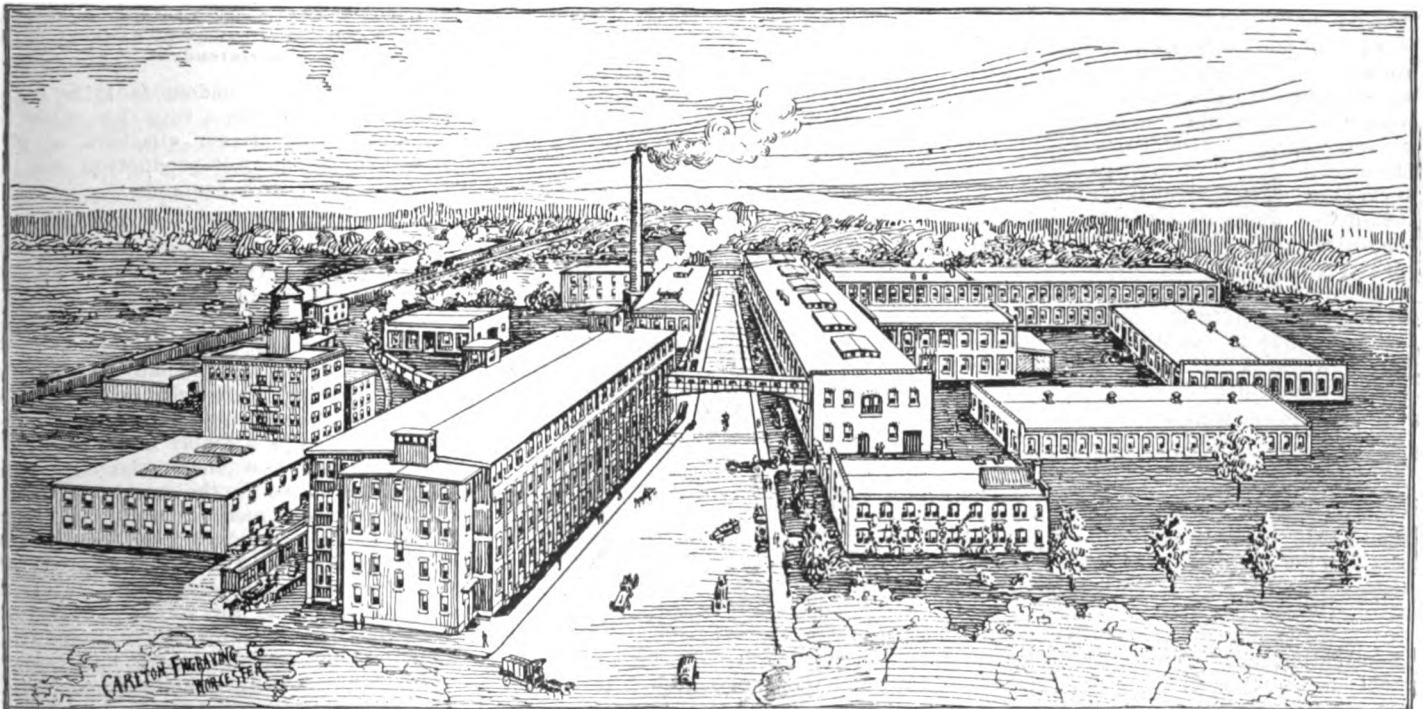


"The Cradle" of the Standard Woven Fabric Company, the Original Plant at Worcester, Mass.

The motorists are gay from the exhilaration of the drive, with never a thought of danger. Suddenly from a cross road dashes another automobile, or possibly a group of school children run into the way. It is then that the brakes must be used quickly and be highly efficient to avert injury or death. That efficiency is largely dependent upon the condition and quality of the brake linings. If these fail the safety of every person may be threatened.

It probably was with such needs as these in mind that an eminent engineer declared that it is more important to stop than to start a motor car. A brake incorporated in a motor vehicle does not necessarily mean that the driver has absolute control of it; the brakes, and particularly the linings of the brake shoes, must be in perfect condition for effective operation. The brake shoes are vitally necessary parts of cars, and one automobile engineer has said that owners should be required by law to have brakes that will have certain efficiency standards, just as they now are compelled to have lights, numbers, etc.

This emphasizes the importance of brake linings, a part of the car of which few motorists have thorough knowledge, even though the brakes are so essential to the safety of those who ride in power driven vehicles. A stiff black band of rough material, it has no attractions for the observer. But its use is almost constant and to insure efficiency care must be taken to have it so that its fullest utility may be realized when needed.



The New Home of Multibestos at Walpole, Mass., a Huge \$500,000 Plant, Containing 175,000 Square Feet of Floor Space and Equipped with the Most Modern of Machinery—The Facilities of This Plant Will Bring the Daily Production of Multibestos up to 35,000 Linear Feet Daily During 1916.

The brakes must be always well adjusted and they must be used intelligently, else there will be unnecessary and destructive wear.

The reader should fully understand the composition of the fabric by which his life and property are safeguarded every time he drives or rides in a car on the highway. He should know how necessary it is that the brake shoes or bands be faced with bands of fabric which will resist the tremendous heat that is generated every time the brakes are applied to stop a car.

Early Types of Brakes.

In the infancy of the automobile industry, car builders equipped their machines with brakes of the metal to metal type. At first this practise was almost universal, chiefly because no satisfactory facing was known. At the beginning of the 20th century automobile brakes were faced with leather or cotton fabric. Both wore quickly, became charred and brittle, failed to clamp the drums satisfactorily when saturated with gasoline, oil or grease, and were rapidly cut by such abrasives as found lodgment on their surfaces.



Arthur H. Burdick, Treasurer and General Manager.

As the speed, power and weight of motor vehicles became greater, the industry sought a friction material that would adequately meet its requirements. Engineers searched assiduously and finally the solution was found in asbestos. This rock mineral has exceedingly high powers of heat resistance and is a non-conductor of heat. It has qualities that are ideal for frictional brake purposes, but how to adapt it was the next problem. In its original state it was difficult to so utilize it that it would not disintegrate under pressure, or would not glaze or wear to uneven surfaces.

Among those who experimented with the problem of adapting asbestos for brake lining were the engineers of the Multiple Woven Hose and Rubber Company, which, in its plant at Worcester, Mass., was engaged in the manufacture of solid multiple fire hose fabrics and solid cotton belting. This company was peculiarly qualified to undertake this work, its equipment including weaving and treating machinery and its management being thoroughly versed in the construction of such machines. The company worked out the practical solution of making asbestos fabric suitable



Stoughton Bell, President of the Standard Woven Fabric Company.

for brake lining by building special looms for weaving it and compounding a chemical formulae for treating the bands. As a result it began the production of Multibestos, a brake lining fabric which today is standard in automobile brake construction.

The prime reasons for the almost instantaneous success of Multibestos are suggested by the name of the fabric. The first half of the word implies that the fabric is a multiple weave, while the last half suggests the asbestos of which it is made. By multiple weave is meant a solid weave in which every thread is tightly bound into a solid mass, it having no loose plies to break under the stresses of brake service, nor containing "stuffers," which is the trade name for layers of loose threads placed between the outer plies solely for the purpose of making the brake lining of a desired thickness.

Features of Multibestos.

In Multibestos the different thicknesses are obtained wholly by the number of solid weaves of the fabric, which makes an interlocking web of asbestos yarn. It was upon this feature of manufacture that the success of Multibestos was and is based and the Multiple company was the first to manufacture brake lining of this type. In 1911 its business had grown so large that a new concern, the Standard Woven Fabric Company, was incorporated to take it over and provide larger production facilities. In the four years the Standard company



T. J. Daley, Sales Manager.

has been in existence the sales of Multibestos have increased more than 1000 per cent. over the sales during the first year of operations.

At the outset the manufacture of brake lining was simply a side line; to-day instead of being a by-product it is the company's main business. It is interesting to observe how this change came about. In 1911 the production of Multibestos constituted five per cent. of the total business. In the following year it amounted to 11 per cent.; in 1913 it leaped to 75 per cent., and in the next fiscal period increased 10 per cent. more.

The astonishing increase in the year 1913 is accounted for by the fact that it was then that the company's two plants in Worcester were abandoned for a new and larger factory in Framingham, Mass., one that afforded 50,000 square feet of floor space and adequate facilities for quantity production. At the time of removal even the most optimistic member of the management felt that there was ample room to take care of any requirements of expansion that could reasonably be expected. This impression did not endure long, however, for early

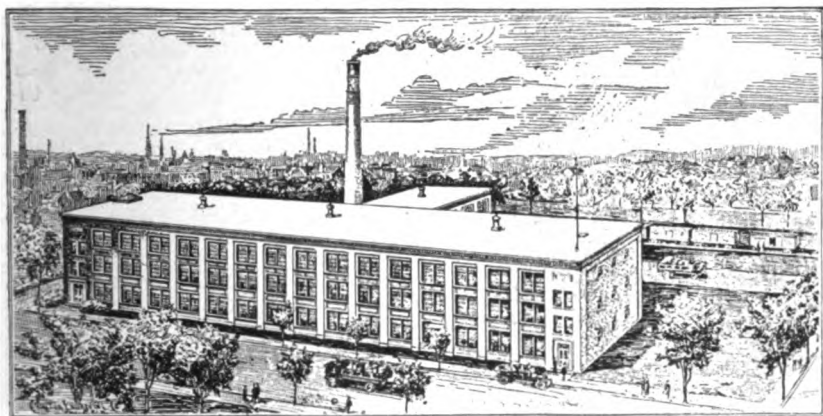


Frederick J. Gleason, General Superintendent.

in 1915 it became evident that the business was growing at a rate that made it imperative that larger quarters be obtained immediately if production was to be kept equal with demand.

The Plant at Walpole.

With this decision begins the third and latest chapter in the growth of the Standard Woven Fabric Company and the production of Multibestos. While considering the addition of new buildings and extensions to the Framingham plant, sufficient to triple its capacity, it was learned that in Walpole, Mass., about 15 miles away, was a highly organized and comparatively new manufacturing plant peculiarly suited to the manufacture of brake lining and mechanical rubber goods made by the Standard company. This plant, comprising 175,000 square feet of floor space and including about 75 acres of land available for future expansion, had been developed for the Walpole Tire and Rubber Company, which had ceased operations. Recognizing the opportunity the Standard company purchased the property immediately and abandoned the idea of enlarging the Framingham plant.



The Framingham, Mass., Plant of the Standard Woven Fabric Company, Which Marks the Second Step in the Development of the Manufacture of Multibestos.

One factor that influenced the purchase was that production could be started there without loss of time, which would be the result if additions were to be built at Framingham.

The negotiations were concluded Dec. 14, 1915, and without delay the company took possession and made such changes as were necessary. Under the Walpole regime the buildings had been developed into an ideal manufacturing unit; they were all comparatively new and of concrete and brick construction, the oldest being not more than five years, and they were laid out in accordance with the latest approved factory construction practice. The aggregate value of the plant and real estate was put at well over \$500,000.

Four months after acquiring the Walpole plant the production of the Multibestos had been increased to about 25,000 linear feet a day, or 7,500,000 a year. And this huge production was made at a time when only a small part of the Walpole factory had been equipped with machinery. When all the new high speed machinery and extra weaving equipment with which this plant is to be provided has been installed the output will be approximately 35,000 feet daily, or 10,000,000 annually.

Uses of Multibestos.

These figures well illustrate the use made of Multibestos in the automobile industry. It is standard on both high and medium pleasure cars and trucks, and is indorsed highly by repair men and garage workers throughout the country for brake linings and for clutch facings. In other lines of industry it has been adapted for use on elevators, cranes, hoists and numerous other mechanisms having frictional stop and start.

The process by which asbestos, which comes from the mine much in the same form as coal, is metamorphosed into a stiff, but yielding fabric, is a very interesting and instructive one to watch. The asbestos rock comes from Canadian mines by the car load and is crushed into a mass as fluffy as elder down under heavy steel rollers in the yarn makers' factories.

Until recently the manufacturers of Multibestos depended altogether upon the yarn manufacturers for their supplies. Since the demand for asbestos yarn has increased to such enormous proportions as it has in recent months,

there have been a number of occasions when it seemed that the company would have shut down its entire weaving department because of the failure of the yarn maker to deliver a shipment on the date promised.

Insuring Quality.

To offset such possibilities and to insure quality the company has installed apparatus with capacity sufficient to guarantee that a certain amount of yarn will always be on hand even though the yarn manufacturers do fail to deliver on time. Thus the makers of Multibestos are now conducting in the new Walpole plant every operation in the manufacture of brake and clutch lining.

The crushing machine, the first step in operations, is housed in a small concrete building adjacent to the larger structure in which are the carding and spinning machines. Here the asbestos rock is crushed and its fibres separated, after which it goes to the picker, an ingeniously contrived apparatus, which combs out the fibres so that they all lay in the same direction. This operation also separates the extraneous matter and dirt from the asbestos stock.

The next step is indicative of the completeness of organization of the plant.

The cleaned stock automatically passes into a small room at the rear of the picker. From here it is blown through a large galvanized tin pipe from the picker and crusher house to the second floor of the neighboring building, where the carding machines are located.

In this department, which is very spacious, there are four air tight rooms into which the asbestos stock is conveyed by blowers. Each of these compartments is situated conveniently to the carders into which the asbestos stock passes next.

Combing the Asbestos.

The carding machinery is standard type and is similar to that used in the cotton and woolen industries. A carding unit really consists of two machines, one of which is known as the "first carder." This machine breaks up the tangled masses of stock as it passes between cylinders on which are wire teeth of varying size and distances apart and combs it out into sheets in which the fibres all lay one way.

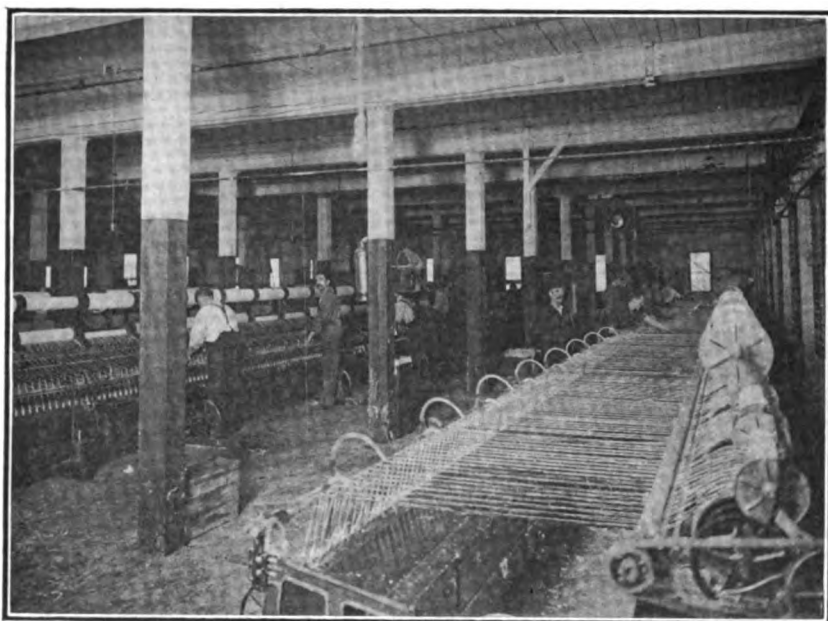
From this machine the asbestos goes to a finishing machine. This apparatus resembles the other, but instead of combing the fibres it twists them into slender and continuous threads. This is done by a series of rollers alternately working sideways, much after the fashion in which a person twists strings between one's fingers. This thread is automatically wound on spools.

At this stage of operations the asbestos first resembles the yarn that will ultimately be used for weaving purposes, but it is too weak to be of practical use. It must be twisted still more and be wound around a brass wire core.

From the carding department the twine is taken to the spinning room, on the ground floor of the same building, where a battery of mules twist the threads until they can be handled without breaking. In this department the mule spinners each have 468 spindles, which is a larger number than is used at this time in any industry, not excepting



The Asbestos Carding Department, This View Showing a Small Portion of the Battery of Machines by Which the Tangled Masses of Fibre Are Broken up and Twisted into Slender Threads.



The Mule Spinning Room, Where the Yarn Is Further Twisted to Increase the Tensile Strength—These Spinning Machines Each Have 468 Spindles, Which Is the Largest Number Used in Any Industry.

cotton, silk or woolen mills.

In these departments one is aware of a cool and moist atmosphere, which is a potent reason for Multibestos quality. If one were to investigate he would find that in the engine room of the plant there is a compartment like a shower bath in which water is sprayed before a powerful fan, which forces the air into large pipes and circulates it throughout the whole factory. By this method, which is known as "washing the air," or humidifying, the atmosphere is not only kept free of impurities, but that degree of moisture which makes for the best results in spinning yarn is constantly maintained. It has been found that in humid atmosphere the yarn breaks less frequently than in dry air.

Incorporating Brass Cores.

At one end of the spinning department are the spooling frames, whereon the asbestos yarn is twisted around brass wire cores, which are incorporated in all Multibestos, brake and clutch lining and gives that surprising strength and flexibility noticeable in the finished product. The customary make-up of this thread is three plies of asbestos yarn to two strands of wire.

Owing to the fact that at present there is not sufficient weaving equipment installed in the new Walpole plant to weave its entire output of yarn, a large part is transported to Framingham to be woven into Multibestos. However, a considerable part is woven in the new Walpole plant, and by the special weaving machinery which the company's engineers have perfected to economize one of the chief sources of large loss in weaving brake lining fabric.

In the old type of loom there are from four to 20 "spaces," that is, there are that number of pieces of brake lining being woven simultaneously. The chief objection to this type of loom is that when it is necessary to stop one "space" every other "space" on that machine must also be stopped. This means that because one piece of yarn has broken or a spool

has been emptied, production must cease on all other pieces, even though there is no "fault" in those "spaces." This has been a great source of loss in weaving, and an exceedingly vexatious problem for yarn producers.

In the new type of loom built by the Standard Woven Fabric Company, each "space" is independent of the others, which not only obviates the necessity of stopping the whole battery of "spaces," but allows the operators to run each at much higher speed than was possible in the past. The new type of machine does not increase the number of workers, because one operator can easily take care of 12 of these new looms.

Weaving is the critical period of brake lining manufacture. Inexperienced or careless operatives can weave the fabric so loosely that it will be useless for motor vehicle uses. Consequently, the Standard Woven Fabric Company em-

ploys none but skilled operatives and places their work under the supervision of an expert weaver whose sole duty is to oversee the weaving operations. This careful inspection is carried out still further in the operations that follow.

Wide Variety of Sizes.

Some idea of the capacity and flexibility of output of these looms can be gathered from a study of the various dimensions of the fabric turned out. Because of the wide range of uses made of Multibestos in motor vehicles and other power driven machines, these looms are adjustable, so that the material can be woven to thicknesses of $\frac{1}{4}$, $\frac{5}{32}$, $\frac{3}{16}$, $\frac{1}{8}$ and $\frac{5}{16}$ inch, and in widths varying by quarter inches from one inch to 20 inches.

This variation in thicknesses is not obtained by using "stuffers," as was pointed out before, but by increasing the number of longitudinal and transverse threads woven into the fabric in a solid mass. Variations in widths are obtained in the same manner. That is why the lining produced by this company is called Multibestos, because of the multiplicity of weaves used.

Another manufacturing economy that the makers of Multibestos use to provide for quantity production, is the method of feeding the yarn to the looms from "beams," which are huge metal spools holding a much larger quantity of yarn than can be wound on the ordinary creels. The yarn is wound from the creels onto the "beams" by special machinery.

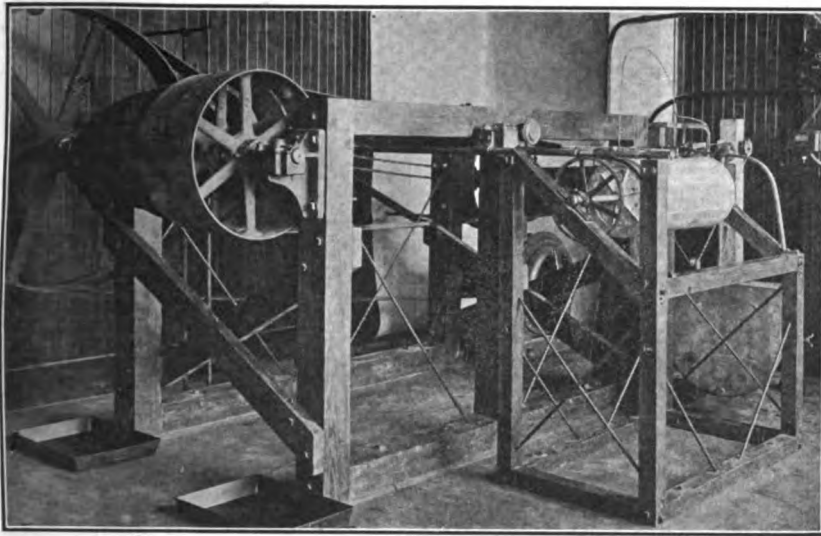
As the fabric is woven it is automatically wound on reels for convenience in handling and is then sent to the treating department, where it is immersed in a special chemical compound, which permeates every fibre and makes the fabric impervious to heat, dust, water, oil and grease. At this point the processes of making brake and clutch linings differ.

The Chemical Baths.

The reels of fabric are placed on revolving axles and fed into the baths, that intended for brake lining going into one



Yarn Twisters, or Spooling Frames, Where the Asbestos Yarn Is Interwoven with Brass Wires to Produce That Surprising Strength and Endurance for Which Multibestos Is Noted.



Section of Testing Department, Showing Special Apparatus by Which Brake Lining Is Subjected to the Same Conditions Obtaining in Actual Service.

bath, while that for clutch facings is fed into another, which is composed of a different combination of chemicals. Directly behind these baths is the drier, the temperature of which is maintained at a constant by a special constructed heating system. From the baths the fabric passes into the drier, which has capacity for 3000 feet at one time and about two hours is required for it to pass through on the scores of rolls on which it is revolved. When the fabric has come out it is thoroughly dried and impregnated with the compound and has had a uniform treatment.

From this department the fabric is fed through gravity elevators to the calender and stock departments on the ground floor. The calendering operation consists of compressing the fabric between steel cylinders and to simultaneously form the selvedge edges and stencil the trade name of Multibestos and the white foot prints at regular intervals on the fabric. The prints are plain white lines, which run across the surface at exact intervals of one foot. They are not only distinguishing marks that identify the fabric, as Multibestos, but serve as a convenient guide for the dealer in cutting off lengths to fill orders.

From the time the raw asbestos mineral is received at the plant until the finished fabric is packed for shipment, Multibestos is constantly subjected to inspections, all of which are just as thorough as that described in connection with the weaving operations. While being fed into the treating compound the work men examine every inch of material as it unwinds before them. Others watch it just as closely as it comes from the gravity elevator into the calendar department, and the men on the calendering machines inspect it as it passes under their vision. The final inspection comes when the finished roll is passed into the stock room, the stock clerk closely examining each roll to determine that it is up to Multibestos standard. Those portions which are defective, and the proportion is exceedingly small because of the extreme care taken in every operation, are thrown on the refuse pile. Having made Multibestos a trade name for high quality, the company's officials

do not endanger this reputation by allowing any part of the product to leave the factory unless it is up to their high standards.

As the brake lining fabric leaves the calendering machine it is automatically wound on reels in 100 foot lengths. Special lengths are made as ordered. The fabric intended for clutch facings is delivered to the clutch department, where it is worked into the different shapes required for disc and cone clutches.

As a further guarantee of quality samples of fabric are periodically subjected to special tests, these reproducing the same conditions as lining would receive in actual service. The room in which the tests are carried out is very interesting, it being equipped with special scientific apparatus which was designed by the company's engineering staff.

Scope of Tests.

The tests are designed to determine the coefficient of friction, the pressure required to resist motion of the contacting surfaces, speed, temperature, chatter and other factors that enter into the

construction and endurance of good brake lining. One part of the apparatus is designed to determine the results of either applying brakes gradually on an automobile running at a few miles an hour up to a maximum speed or of sudden locking the brakes. The results are charted on a revolving drum and furnish a constant study by the engineers endeavoring to further perfect the quality of Multibestos.

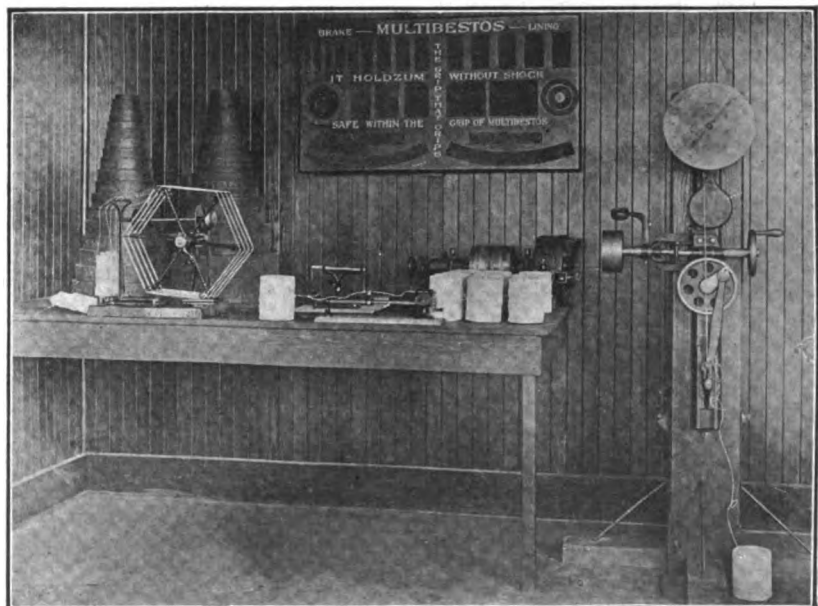
This constant effort to improve the quality of Multibestos is a noticeable factor in the operations of the Standard Woven Fabric Company. It would seem that Multibestos had already been developed to the highest possible point of efficiency, and yet the management is always seeking to discover new processes or to evolve new machinery that will benefit the users of its brake lining.

Both the Framingham and the Walpole plants are splendid examples of this policy, they being equipped with all the latest approved devices for bettering working conditions and augmenting volume of output. All departments are closely co-ordinated and highly organized, which is a tribute to the personnel of the company's management and a reason for the great success achieved by the makers of Multibestos.

Personnel of the Company.

It has been said that to one man more than all others belongs the credit for the growth and prosperity of the Standard Woven Fabric Company. That man is A. H. Burdick, who has been the treasurer and general manager since the original incorporation of the company in 1911. He is a man of wide business experience and has demonstrated that he is a tireless worker. Before associating in the making of Multibestos, Mr. Burdick was at the head of the purchasing department of the General Electric Company at Schenectady, N. Y.

Another widely known and forceful member of the company's personnel is Frederick J. Gleason, who founded and for many years was the general superintendent of the Walpole Tire and Rubber



Special Apparatus by Which Asbestos Yarn Is Tested for Tensile Strength, Weight, Twists and Other Factors That Make for Good Brake Lining.

Company. In that capacity Mr. Gleason became distinguished in the rubber industry because of his original work in the compounding of rubber and the manufacture of rubber goods. In his new connection, Mr. Gleason has charge of the factory interests, a position for which he is peculiarly fitted.

The presidency of the company is held by Stoughton Bell of Boston, he being active in this capacity and also serving as the company's general counsel. The sales department is in charge of T. J. Daley and it is largely through his efforts that the company has secured numerous contracts for brake lining and clutch facing from the leading motor car manufacturers.

The foregoing paragraphs have been devoted to the production of brake and clutch linings because these are parts of a motor car in which automobile owners and operators are most interested, and because they form the greater part of the Standard company's production. The other items of the output are rubberized cotton cloth, friction and tire tapes and insulating compounds, corrugated matting and insulating varnishes, all of which have the same high degree of reputation for quality as Multibestos brake and clutch linings.

EXHIBITION OF DRAWINGS.

The annual exhibition of students' drawings made in the Technical School for Carriage Draftsmen and Mechanics during the season just closed took place recently in the school rooms at 20 West 44th street, New York City. There were 15 graduates, eight from the evening class and seven from the day class, they constituting the largest body ever graduated from this institution. The showing was fully up to the usual high standard established by this school and was attended by a large number of visitors, prominent among whom were professional draftsmen and foremen. While the day and evening departments are now closed for the summer, the correspondence department is kept open the year round. Particulars can be obtained from Andrew F. Johnson at the school.

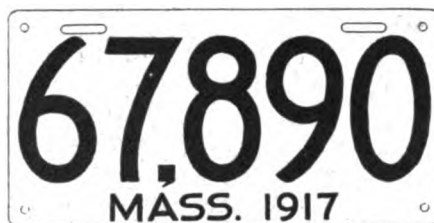
CHICAGO HAS MOST CARS.

A recent compilation of the number of motor cars owned in various cities of the United States with more than 100,000 inhabitants shows that Chicago with a population of 2,185,283 has 43,238 cars, which is 5000 more than New York City, which has 38,921 with 4,766,883 population. This, of course, does not include the immense suburban territory just outside of New York, but only the territory inside of the city limits.

As might have been expected, Detroit has the most cars in proportion to the population, or 30,949 to 465,766, which was its population when the 1910 census was taken. Baltimore and New Orleans are among those with the smallest number of cars to population. All southern cities suffer in the comparison.

NEW MASSACHUSETTS PLATES.

Difficulty in reading the numbers on the license plates of motor cars when they are going with any speed has led the Massachusetts Highway Commission to adopt a new form of plate. Most of



The Bury System Adapted to License Plates.

the trouble comes from mistaking certain figures for others and failing to recognize the number of units in a long number.

The railroads for purposes of car checking have been faced by a similar problem and George Bury, first vice president of the Canadian Pacific system, has worked out a system of numbering on scientific lines. In the Bury system the figures are specially shaped for legibility, with commas separating the digits indicating thousands and hundreds.

The first lot of these plates is to be issued to motorists licensed under the new law, which for a low fee permits residents of New Hampshire to operate their cars 15 miles inside of the Massachusetts state line. It will be adopted for all the plates used in 1917.

An order for over 200,000 plates has been given a maker, who will produce them at a little less than eight cents each. They cost motorists 75 cents, but that includes clerical work and overhead.

EAGLEINE IN NEW HOME.

Because its business had outgrown the capacity of its old quarters, the Eagle Oil and Supply Company of Boston has been forced to seek a new location with room sufficient to provide for the present business, as well as to allow for future expansion. The company is now located in the big and modern office and show room building at 44-45-46 In-

dia street, in the heart of Boston's supply district, where every facility has been provided to make this company the largest and best equipped oil and engine supply house in New England.

The Eagle Oil Company is best known in the automobile trade as the proprietor of "Eagleine Auto Oils," which have been on the market for 20 years and during that time have proved eminently satisfactory to users in all parts of the United States. This company also handles Perolin, the metal treatment which is said to be the most scientific preparation for cleaning boilers internally.

The company's oil department in the new quarters is located on the India street floor, where there are large and well fashioned display windows. On the Wharf street side is the shipping department. The main office and supply and general stock room are situated on the second floor.

Mr. C. N. Goward, president and treasurer, who has been at the head of the company since its inception, in speaking of the success of the Eagle Oil Company, said:

"Naturally we feel proud of the fact that we are headed upward. For 23 years we have made and sold the very best oils that could possibly be produced. In Eagleine Auto Oil we were the first to produce an oil with a consistency and fire test of the present Eagleine Light Auto Oil. We have never felt it necessary to make a change in it. Our success proves its value.

"When gas engines were first produced it was commonly felt that it was necessary to use high fire test heavy oil. We experimented for more than one year and we ran an old Pope-Toledo car 10,000 miles during the trials and the valves and pistons were closely watched to ascertain carbon properties and lubricating qualities of that character. Then it was decided to put this oil on the market. Instantly it had great success and today we feel highly complimented that so many of our competitors state that their oil is "just as good as Eagleine."

STOP TRUCKS ON SUNDAYS.

Motor cars that are registered as commercial vehicles in Massachusetts under a special rate, which confines them exclusively to use as commercial vehicles, are being stopped and their drivers summoned when they are found on the boulevards carrying passengers on Sundays. A man who used a Ford runabout in his business on week days was arrested recently on Sunday because the license plate which the car carried was marked with a B, which indicated that it was a commercial license.

The highway commission will not register as commercial vehicles runabouts or other passenger cars used to carry salesmen or other business men from place to place. Under the law old touring cars of high horsepower which would ordinarily be rated at \$20 or \$25 a year, are running under commercial licenses at \$5 a year.



C. N. Goward, President and Treasurer of the Eagle Oil and Supply Company of Boston.



Tarvia with Slag—

EVERY year new uses have been found for Tarvia. When first introduced, some ten years ago, it was simply a macadam road preservative and dust preventive.

Since that time various grades have been developed to meet varying road conditions.

For instance, there is a grade of Tarvia that is an ideal surface coating for concrete; there is another grade for use in resurfacing old, worn out brick and other block pavements; another for patching sheet asphalt and other bituminous pavements.

Now comes news from the field establishing clearly the value of Tarvia for use in conjunction with slag for roadmaking.

In some parts of the country blast-furnace slag is abundant and cheap, cheaper

than other forms of road metal. Experience has shown that this material gives excellent results when bound with Tarvia.

Several such roads have been built, for example, the Mount Hope, Lafferty and Bannock Turnpike, Belmont County, O., built in 1912 and 1913. The photograph was taken in 1915, showing the surface still firm and the contour perfect.

Mr. W. H. Taylor, Road Commissioner, writes:

"I don't know how we got along so many years without our tarvia-slag roads. The people along the line think it the only road. In my own opinion there is no other road that excels this kind when built according to the specifications."

Our Service Department is ready and anxious to answer any questions regarding road problems that you may wish to write about. Address our nearest office.

Special Service Department

This company has a corps of trained engineers and chemists who have given years of study to modern road problems.

The advice of these men may be had for

the asking by anyone interested.

If you will write to the nearest office regarding road problems and conditions in your vicinity, the matter will have prompt attention.

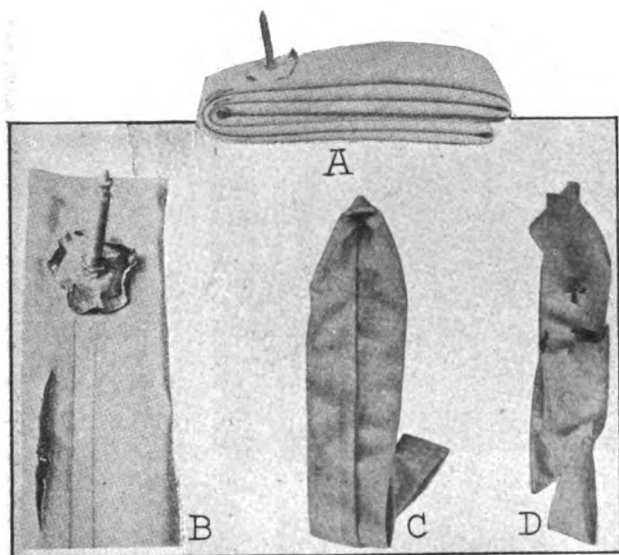
The *Barnett* Company

New York Chicago Philadelphia Boston St. Louis Cleveland Cincinnati
Pittsburgh Detroit Birmingham Kansas City Minneapolis Salt Lake City Seattle Peoria
THE PATERSON MANUFACTURING COMPANY, Limited: Montreal Toronto Winnipeg
Vancouver St. John, N. B. Halifax N. B. Sydney, N. S.



PROPER CARE AND REPAIR OF PNEUMATIC TIRES.

If the motorist is to obtain the maximum of service from his car he must during the general overhaul of the machine's components give particular attention to the condition of the tires, and prepare them so that they will afford the greatest possible mileage. Unless this is done, and, of course, provid-



A, Tube Allowed to Contact with Grease, Oils and Sharp Edged Tools; B, Tube Pinched When Replacing in Casing; C, If an Effective Lubricant Is Not Placed Between the Tire and Tube the Removal of the Latter Is Apt to Result in the Condition Shown; D, Tube Ruined by Running Flat.

ing that he continues during the season to accord them the care that they should have, he will find that the cost of operating the car will be far greater than if they had been placed in perfect operative condition.

While the car owner cannot reasonably expect to avoid the necessity of roadside repairs during the driving season, there are a number of things which he may do for the tires that will prolong their life and dependability. Probably chief among the precautions a motorist should observe is that which concerns inflation pressures. The tire manufacturers are constantly urging the users of their products to observe the pressure schedules they have so painstakingly prepared, which are the result of scientific study and tests and are designed to afford the fullest benefits in service.

Unless tires are at all times kept filled with air so that they maintain their roundity, even when subjected to the weight of the car and its load, the fabric will soon be weakened by contact with the irregularities of the highways' surfaces and will disintegrate under the resulting weaving strain. Another argument for maintaining proper pressure is that a fully inflated tire is less liable to punctures or cutting by sharp stones, nails, glass and the like.

Before taking the car out on the road the tires should be examined for small cuts and bruises, and if there are any they should be repaired. It is better to attend to these matters at once than to allow the cuts and bruises, etc., to become so enlarged that the result is a blow out. In fact, it is good practise during the season to always examine the casings after returning from a ride and to make the repairs before taking the car out again.

For this purpose a small vulcanizer is very economical equipment for every car. Its use will be found to be the

means of avoiding costly tire repair and replacement bills. There are several types now on the market which are designed especially for roadside and private garage repairs, and they can be operated by almost anyone. The process consists of simply clamping the vulcanizing part over the break and turning on the heat. Generally they are so constructed that it is almost impossible to do the work in the wrong manner, and so that the tire can be repaired while on the car and fully inflated.

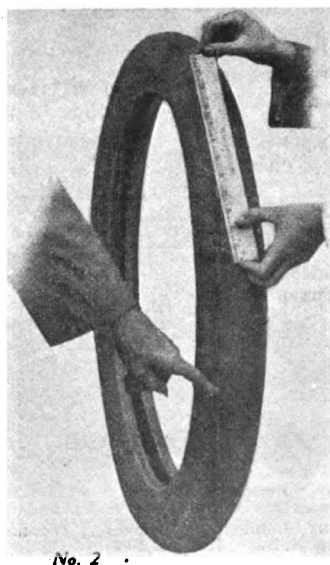
There is no other method so satisfactory for mending small cuts, which if neglected will admit moisture to rot the fabric. If a cut is allowed to develop to that point, then the repair work will have to be done by an expert repair man, or it may be that the damage will be so great that the only practical thing to do is to put on a new casing.

Beside accidents on the road, there are several ways in which a tire can be injured through carelessness and ignorance. One is to allow oil or gasoline to remain on the casing or inner tube, because both these liquids have the property of dissolving rubber and causing rapid deterioration. Another way in which they are often harmed is to allow rust on the steel rim to remain so as to damage the rubber and fabric. The rust should be removed frequently and periodically. It is said that if the rim is painted with a mixture of oil and flake graphite which has been worked up to about the consistency of a paste, rust will be prevented.

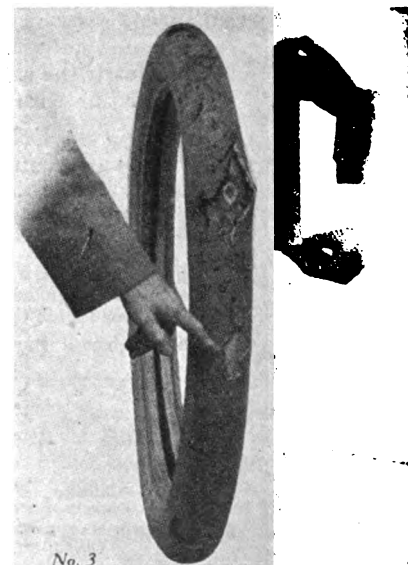
Experts in the use and construction of tires declare that the constant contact of a shoe with the road surface creates friction between the inner tube and the casing. This friction can be materially offset by dusting the inside of the casing with powdered soapstone or flake graphite. It is also good policy to do this when inserting new or old tubes, because the graphite or soapstone will prevent kinking or pinching of the tube.

The extra casing carried for emergency purposes should be protected from heat, light and dampness. Special tire covers are obtainable at moderate prices, but in lieu of these a winding of rubber cloth will be sufficient, though, of course, not so satisfactory or neat in appearance as the specially designed covers.

Regarding inner tubes, never carelessly toss them into the tool box or under the seat. The tools will chafe and cut them and the oil and grease will have the effect of rotting them. They should be dusted with powdered soapstone, carefully folded and then tied up with a broad tape. It is a good plan to place each tube in a separate soft canvas bag that has been dusted with soap stone. Store the tubes in some part of the car where heat and oil cannot reach them.



No. 2



No. 3

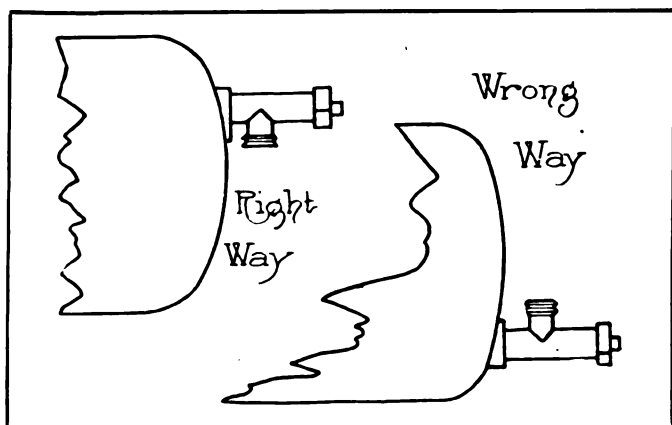
Tires Are Ruined Through Neglect—No. 2 Shows How a Minute Cut Commences to Extend; No. 3 Illustrates the Tire's Complete Downfall, Which Could Have Been Avoided by Daily Inspection and Repairs.

ACETYLENE GAS LIGHTING SYSTEM.

Because of the simplicity of design of the acetylene gas lighting system thousands of car owners continue to use them, despite the fact that the majority of recent pleasure car models are provided with electrical lighting systems. One of the most widely used of the gas systems is that produced by the Prest-O-Lite, and although it is one of the simplest made, there are many car owners who either through lack of knowledge of its requirements or through carelessness fail to give it the attention that it requires in order to obtain the maximum of service.

In order to give proper care to the Prest-O-Lite system one should understand its construction. The tanks, or cylinders, are of seamless steel and contain a number of asbestos discs which have been saturated with a chemical that has the property of dissolving and absorbing acetylene gas. It is because of this property that such a large quantity of gas can be stored in such a small container as the Prest-O-Lite company uses.

These cylinders are charged at the Prest-O-Lite factory to a pressure of 225 pounds, or approximately 15 atmospheres, and as the gas is used on a car the amount remaining in the tank is registered on the gauge attached to one end of the cylinder. This gauge has caused many owners considerable worry. During cold weather a new tank may register only 135 pounds, while in the summer it may show 315 pounds. The cause for this is that the pressure varies according to the degree of temperature. These fluctuations do not in any manner indicate that the quantity of gas is



The Valve Should Always Be Uppermost if a Free and Unobstructed Flow of Gas Is to Be Maintained.

either above or below the standard set by the manufacturer, because the contents are determined by weight and not by volume. To satisfy himself as to this the motorist may demonstrate the fluctuations by taking the tank from a warm into a cold room, or vice versa, and note how the gauge's needle advances or retreats, as the case may be.

Three styles of gauges are used in connection with Prest-O-Lite tanks, one registering pressure in atmospheres, another in pounds and the third in both atmospheres and pounds. In estimating pressure in pounds on an atmospheric gauge multiply the pressure in atmospheres by 15.

One of the distinguishing features of this type of gas tank is the means provided for safeguarding against fire. Near the pressure gauge is a safety plug and incorporated in the valve of the cylinder is another of these devices. The plugs are made of a relatively soft metal which has a low melting point. It is because of these safety plugs that a fully charged Prest-O-Lite cylinder does not explode even though subjected to fire. A garage may be burnt to the ground or a car entirely destroyed by flames, but before the heat becomes intense enough to seriously effect the gas in a Prest-O-Lite, the metal of the safety plugs melts and the gas escapes from confinement.

Some owners in installing a tank place the valve in the wrong position. It should always be uppermost, as shown in the accompanying illustration. In this position a free and unobstructed flow of gas is maintained. If the valve is down the chemical in which the acetylene is dissolved may escape

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THOSE who desire from their engines the utmost efficiency and the utmost reliability, who desire to be without the annoyance of constant battery attention, insist on

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Bosch Magneto Co., 204 West 46th St., New York

For Perfect Control and Safe, Comfortable Driving Use

Weed Anti-Skid Chains

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Peerless Quality in Smaller Size

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Makers also of the "48-Six" and Peerless Trucks.
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TIMES BUILDING, PAWTUCKET, R. I.

What Standardization Means to Automobile Buyers

IT means VALUE. Just to the extent that a car is standardized does the buyer's dollar approach the maximum of purchasing power.

Standardization means definite, proved quality, known manufacturing costs and reduced selling costs.

Of the million autos that will be sold in 1916 75% will be standardized cars selling for less than \$1,000.00 each. This remarkable American achievement is the direct result of standardization.

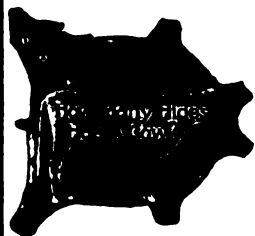
Finally the upholstery has been standardized by the almost universal adoption of



MOTOR QUALITY

40% of all 1915 cars sold were upholstered in this proved, guaranteed material and in 1916 the total will be at least 60%.

Fabrikoid is the standardized automobile upholstery. It wears better than coated splits (commonly sold as "genuine leather") and has the artistic appearance and luxurious comfort of the best leather.



Raynite Fabrikoid for tops, single or double texture, is guaranteed one year against cracking, but made to last the life of the car.

To get the most for your money, buy a standardized car.

Du Pont Fabrikoid Company
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The Hartford
SHOCK ABSORBER

Makes ROADS LIKE THIS
FEEL LIKE THIS

Stops jolting, jarring and vibration. Eliminates side sway. Contributes to solid auto comfort. Prevents spring breakage. Makes tires last longer. Cuts cost of maintenance. Insures longer life for your car. Complete literature on request. Write mentioning make, model and year of car and we will advise how to equip to secure genuine comfort. Your new car will be Hartford-equipped if you insist.

HARTFORD SUSPENSION CO.
E. V. Hartford, Pres. 147 Morgan St., Jersey City, N. J.
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cars have established a new field for luxurious light roadsters. You may judge their value by their standard of ownership.

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For Transmissions and Differentials

contains the only form of graphite that's fit for automobile lubrication. Booklet No 210-G.

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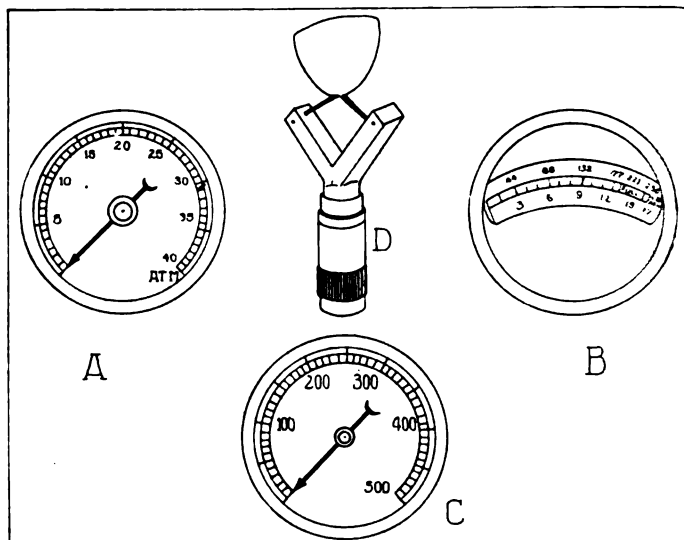
G-45

into the pipe line and check the flow of gas and discolor the flame.

The Prest-O-Lite company advises that a tank should not be attached to the car in any position where it is apt to be mutilated or worn by contact with other articles. In some instances a cylinder has been allowed to jolt against a bolt head or other projecting points, until it was damaged beyond repair. A little care on the part of the user will avoid any such injury.

One of the chief reasons for light inefficiency is leaks in the pipe lines. After long exposure in the open air, rubber tubing will rot and crack. Leaks developed in this way may easily waste more gas than is burned in the lamps. Occasionally test the tubing. Light the lamps and then carefully go over all tubing and connections with heavy soap suds. Wherever there are any leaks, bubbles will arise. The proper remedy for leaky tubing is to replace it with new. If there is a leak at the joint that holds the burner in the lamp, coat white lead on the threads. Do not use a naked flame when searching for a leak.

The following are the places susceptible of leaking: At the point where the union attaches to the tank, in the rubber hose connecting the union with the brass piping of the car, at the joints where the hose connects with the union and piping of the car, at joints, F's or X's, where branch lines are piped off, where the rubber tubing connects with lamps, at the bottom of lava, at the joint where burner stem connects with the pipe line and at any point along pipe lines where



A. Gas Tank Gauge Indicating Atmospheres; B, Gauge Indicating Pounds and Atmospheres; C, Gauge Indicating Pounds; D, the Proper Height of Flame.

chafing is likely to occur.

The height of the flame is important. It should be as high as possible without causing blowing. The correct flame will be nearly level across the top. If it is too high there is a waste of gas and damage may also be done to the reflector. A practise much indulged in by some owners is to turn the flame down so low that the two tips of the flames do not meet. This practise is never recommended, as it has a tendency to carbonize the burner.

The proper focus of the lamps is of the uttermost importance if the owner desires to obtain the best results. To test the focus, hold a white sheet about three or four feet in front of the lamp. If it is correct a clear, white field of light and a clear inverted picture of the burner and flame will be shown. If, however, a round or crescent-shaped dark spot appears, the lamp is out of focus and the burner or mirror must be moved forward or backward until the dark spots disappear.

Users of the gas tank are cautioned against opening the valve too wide when lighting the lamps. The valve should be turned slowly with the key, and the flame should never hiss or tremble when the match is applied. This caution does not apply, however, if an automatic reducing valve is fitted, as this insures the correctness of the flame regardless of the extent to which the valve may be opened.

The proper angle of the lamps is also of the greatest im-

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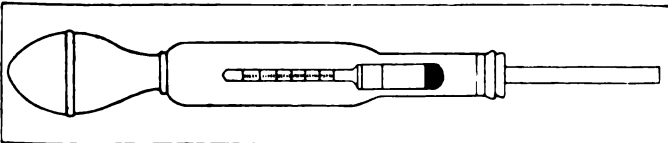
portance. The face of the lamp should be perpendicular. If tilted up the light goes too far in advance of the car and if tilted down the rays strike too near the machine. The position of the lights is easily tested with a plumb line. If the lamps are mounted high, it may be necessary to slightly tilt them so that the main beam of light will strike the ground approximately 30 feet ahead of the car.

CARING FOR STORAGE BATTERY.

Because of the great favor with which electric lighting and starting systems have been received by motorists, storage batteries are now a part of the equipment of every up-to-date car. This condition has resulted in the placing of thousands of batteries in the care of those whose knowledge concerning their construction and maintenance can at the best be termed but elementary.

If the storage battery is handled properly it will afford satisfactory service indefinitely, but, like a good watch, it is neither trouble nor fool proof and will consequently suffer from lack of care or unintelligent handling. Considering the slight attention accorded them, it may be said that the ailments of storage batteries are comparatively few, the most annoying of which is the so termed "dead battery."

A dead battery is one that has become exhausted and delivers little if any current. In such a case the first step is to ascertain if the generator is delivering its proper supply of current. The storage battery is not a creator of current, but is dependent upon the generator which is driven by the engine, to keep it fully charged. If the battery is dead, introduce an ampere meter in the battery circuit and note the amount of current being delivered by the generator at the different engine speeds. If the car manufacturer advises that at a car speed of 12 miles an hour the generator should deliver 10 amperes, and it is found by test that at this speed it is delivering but six or seven, adjust the generator so that it will give the desired output.



Type of Hydrometer Syringe Utilized for Testing Electrolyte of Storage Batteries.

When a battery has not been properly charged by the generator and has been allowed to fall behind, it will not store the current supplied by the generator even though the latter be adjusted to give its proper output. The reason for this is that the battery is said to be in a stale condition and, therefore, will not hold the charge. The only remedy for this is to take it to an expert and have it charged according to the instructions given by the manufacturer of that battery. Have an experienced mechanic adjust the generator so that it will supply its proper amount of current or energy at given engine speeds and then replace the properly charged battery.

On the up-to-date cars there is an ampere meter mounted on the dash of the car. This instrument indicates the amount of current passing from the generator into the battery. The car operator should watch this instrument, as it shows the conditions existing in the generator.

Faulty lamp sockets may also be the cause of a storage battery losing its current. If it has been determined that the generator is not the source of trouble, examine the lamp sockets and look for looseness and poor contacts. Correct any faults at once. Next investigate the lighting and starting switches and ascertain that they return properly to the "Off" position when the current is not being used. Also determine that there are no broken wires, loose strands or worn insulation. Insulation is apt to wear at points where the cables rub against the car frame or other metal parts. Next inspect the lamps to determine that the battery is not over taxed. The total candle power of the lamps used should be in proportion to the capacity of the battery.

If it is now found that the components of the systems are in proper order and yet the battery does not register its full efficiency, recall if the car is used more at night than in the day time. At night time the lights are continually in use

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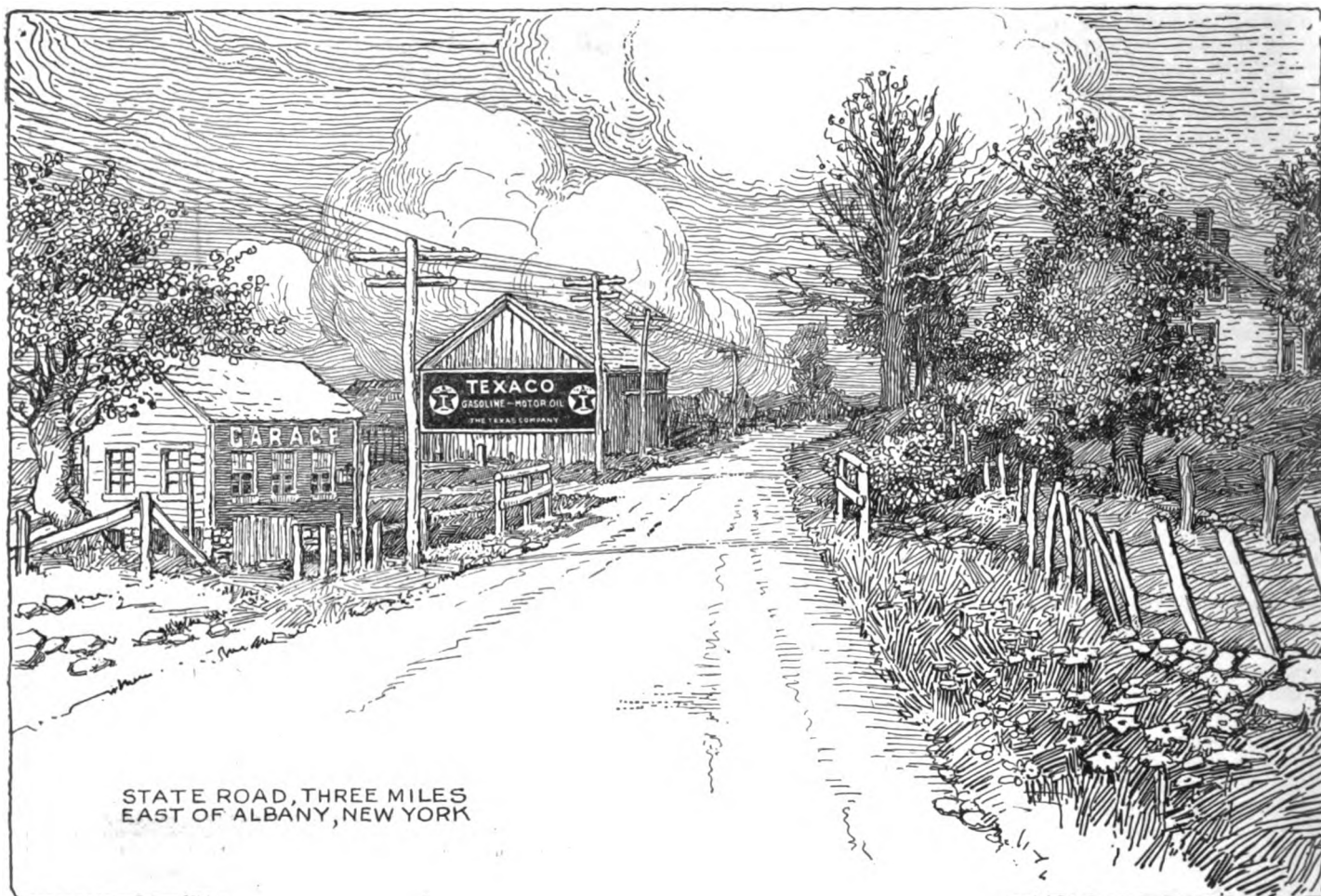
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"D. & C. A SERVICE GUARANTEE"

Daily service between Detroit and Buffalo and Detroit and Cleveland. Day trips during July and August, as well as two boats out of Detroit and Cleveland every Saturday and Sunday nights during these two months. **FOUR TRIPS WEEKLY FROM TOLEDO AND DETROIT TO MACKINAC ISLAND AND WAY PORTS—From June 25th to Sept. 10th, SPECIAL STEAMER CLEVELAND TO MACKINAC ISLAND. TWO TRIPS WEEKLY. NO STOPS ENROUTE EXCEPT AT DETROIT EVERY TRIP.** Daily service between Toledo and Put-In-Bay, June 10th to Sept. 10th.

RAILROAD TICKETS ACCEPTED ON D. & C. Line steamers between Detroit, Cleveland and Buffalo, either direction. Send two cent stamp for illustrated pamphlet and Great Lakes Map. Address L. G. Lewis, G. P. A., Detroit. DETROIT & CLEVELAND NAVIGATION COMPANY P. H. McMILLAN, Pres. A. A. SCHANTZ, V. P. & G. M.



and, therefore, there is a steady drag on the battery. By not operating the car in the day time when the lights are not used, the generator has not had a chance to do its work, and a dead battery resulting from this cause is neither the fault of the battery or generator. When the car is used mostly

will more quickly cause loss of capacity and final ruin of a storage battery than to allow the plates to become dry.

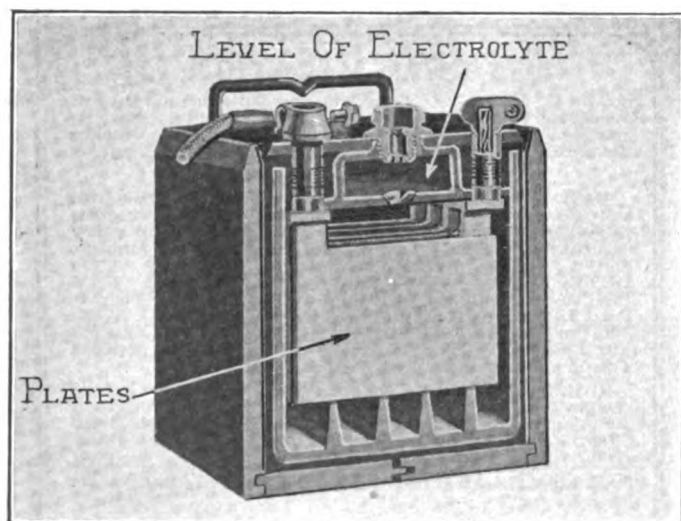
CARE OF THE COOLING SYSTEM.

In the majority of cases motorists who have operated their cars during the winter months have used anti-freezing solutions in the cooling system. To remove this solution does not require only the mere opening of a few pet cocks and the draining away of the fluid, but there are certain operations that are necessary. Even the novice knows that much of the motor's efficiency depends upon the proper radiation of the heat developed by the explosions, therefore the greatest care possible must be taken to maintain the radiator at its maximum efficiency.

If the fluid has been used in the system for a considerable time, it will be surprising to note its appearance when drained through the pet cocks. It will be a brick red color, which the average person is apt to believe, is the result of rust. The use of hard water in the system is the real cause. Hard water forms what is termed boiler scale, which deposits in the cooler in the form of a fine, brick colored powder. Radiator manufacturers generally advise the use of distilled water in the cooling system, but because of the trouble and the expense involved, attention is seldom given to this suggestion.

To afford the proper care to the circulating system, open all pet cocks and drain off the solution. Next dissolve common washing soda crystals in water until a solution is obtained. About five gallons of water should be used for the purpose. Close all pet cocks and pour the mixture into the radiator and start the engine. It is then good practise to take the car out on the road and operate it for a few hours. The reason for this is that the solution is forced to all parts of the system, and, assisted by vibration, causes all encrustations to be loosened.

The next step is to drain off the soda solution through the pet cocks and then flush the entire system with clear water. Continue flushing until the fluid running from the pet cocks appears clear.



Section View of a Well Known Type of Storage Cell—Maintains Proper Electrolyte Level so That Plates Will Be Covered.

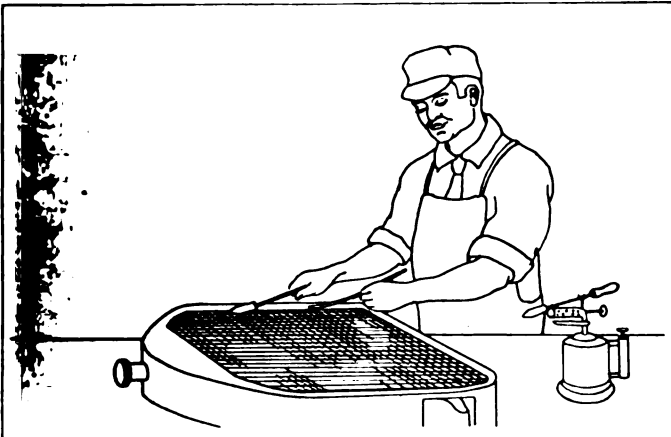
at night and but little in the day time, the engine should be operated for a short time each day so that the generator can charge the battery.

Last, but not least, do not forget that it is essential to keep the battery plates covered with the electrolyte. Remove the vent plugs from the top of the battery cells at last once a week and test the specific gravity of the fluid with a hydrometer and also note that the plates are covered with the solution. It should be remembered that there is nothing that

Now open the hood and cover the entire engine with a water proof covering. Next direct the stream of water at the back of the radiator. The force of the water will remove dirt and other foreign matter from between the fins and tubes. Allow the water to flow slowly at first so as to loosen the matter and then gradually increase the pressure so as to force the substance out.

When a radiator is thoroughly cleaned in this manner, minute leaks may be disclosed. If a leak is large or in an inaccessible place, it is better to have the repair done by an expert work man, but if it is a small leak and in an accessible place, the work can easily be done by the car owner. Remove the radiator from the car and lay it flat on the work bench. Thoroughly clean the defective spot and puddle the solder for the entire area. When replacing the cooler do not tighten the retaining nuts so that they strain the studs.

If glycerine has been used as the anti-freezing ingredient, make it a point to examine the rubber hose connections to determine that the line is in good condition. Glycerine has a tendency to separate the fabric from the rubber covering, thus impeding the flow of water and often resulting in an overheating trouble, which is difficult to locate. If the ma-



To Repair a Small Leak Lay the Radiator Flat on the Bench and Puddle the Solder Over the Entire Area.

terial appears to be deteriorated, install a new hose connection.

INFLATING TIRES BY HAND PUMP.

Not every motorist knows how to use a hand pump to inflate a tire in a manner to economize his strength. When the work is hard the pump is usually blamed as worthless. More often the fault lies with the operator.

It is not necessary to exert a great amount of strength to obtain the proper air pressure, if a little consideration is given to the tire valve. This valve is designed to open when the air from the pump presses against it and to close when the pressure ceases. If it is too tight there will be much resistance, which will make the work hard and cause leaks.

To inflate a tire easily, slightly loosen the valve. After operations adjust it to fit snugly, but not too tightly. If it is found that it is necessary to screw down the valve very tight to prevent leakage of air, it is economy to clean it thoroughly, or even to substitute a perfect one. It is well to remember that by tightening the valve too much the rubber packing will be destroyed.

STUDEBAKER REFINEMENT.

One of the most noticeable of the many refinements incorporated in the series 17 Studebakers is the radiator guard. This feature prevents mud or water from splashing over the front of the car, serving in the same capacity as do fenders.

TREATING BRAKE BANDS.

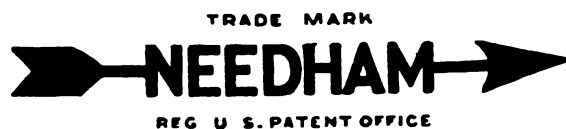
If a grease gun be filled with kerosene and the contents squirted on the brake bands it will add greatly to their gripping quality. The kerosene will dissolve any oily or greasy matter and leave the gripping surface clean.

(When Writing to Advertisers, Please Mention The Automobile Journal.)

59

Leading Car Builders Equip With This Plug





Highest Quality in Design—Workmanship—Material
Not Theory But Proven Facts

**You Have Tried the Rest
 Now Get the Best**

NEEDHAM TIRE COMPANY
 Charles River, Massachusetts

WHY FREEZE YOURSELF ? RUIN YOUR AUTO ?

Write for full
 particulars



HEAT YOUR GARAGE WITH A
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Burns Natural or Artificial Gas
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 No Gas or Fumes Can Enter Heater

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BRISCOE

“A line of three leaders”

Briscoe Twenty-four, \$585, electric starting and
 lighting; full equipment.

Briscoe De Luxe Eight 38 \$950; Four 38 \$750.

Write or wire.

BRISCOE MOTOR COMPANY
 109 Wildwood Avenue, Jackson, Michigan

Polarine

THE STANDARD OIL
 FOR ALL MOTORS

Standard Oil Company of New York

MASTER CALORITE SPARK PLUGS

The highest achievement in spark plug construction—
 All standard threads carried in stock—

Master Calorite Spark Plugs are backed by this broad guarantee—
 “We guarantee Master Calorite Spark Plugs against defects of material or workmanship
 and will replace free of charge any Calorite insulators broken by heat which are re-
 turned to us transportation prepaid.”
 Try Master Calorite Spark Plugs—Send for illustrated literature and
 trade proposition.

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24 Issues

\$1.50 the Year

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ADJUSTMENT BASIS OF TIRES.

(J. B., Brookline, Mass.)

Can you publish a list showing the mileage on which different makes of non-skid tires are adjusted? By this I mean the number of miles that the manufacturer guarantees a tire to give service.

From the latest data received from the different tire manufacturers we have prepared the following table. It should be remembered, however, that these figures are subject to change:

Name	Tread Name	Mileage
Acme	Dimple	3,500
Acme	Hemisphere	3,500
Ajax	Non-Skid	5,000
Braender	Bull Dog	3,500
Brietson	Non-Skid	10,000
Centaur	Non-Skid	6,000
Carspring	Anti-Skid	5,000
Cleveland Standard	Standard	5,000
Columbia	Non-Skid	4,000
Combination	Hold-On	5,000
Combination	Keaton	5,000
Dayton	Non-Skid	6,000
Delion	Non-Skid	5,000
Diamond	Squeegie	3,500
Empire	Red	5,000
Falls	Never Slip	5,000
Federal	Rugged	3,500
Firestone	Non-Skid	3,500
Fisk	Non-Skid	3,500
Fisk	Red Top	4,000
Goodrich	Safety	3,500
Goodyear	All Weather	3,500
Hood	Arrow	5,000
Kelly Springfield	Kant Slip	6,000
Knight	Non-Skid	5,000
Lee Puncture Proof	Zig-Zag	3,500
Lee Puncture Proof	No Puncture 3500 Miles	5,000
Marathon	Angle	5,000
Michelin	Universal	3,500
Midgley	Wire	6,000
Miller	Geared to the Road	4,500
Nassau	Non-Skid	3,500
Pennsylvania	Ebony	5,000
Pennsylvania	Vacuum Cup	6,000
Puritan	Gripper	3,500
Quaker	Non-Skid	4,000
Racine	Anti-Skid	4,000
Racine	Red Cord	5,000
National	Redwall	5,000
Republic	Staggard	4,000
Republic	W. M.	4,000
Swinehart	Depression Type	3,500
United States	G. & J. Usco	3,500
United States	Chain	3,500
United States	Nobby Tread	5,000
United States	Royal Cord	3,500
Wilson	S-S-S	10,000

TRUCK DOES NOT CLIMB HILLS.

(T. S. B., Webster, Mass.)

I recently purchased a second-hand — truck from a dealer in Worcester, Mass. When given a demonstration, the truck climbed steep grades in that city on the high gear with

ease. This was one of the chief reasons for my purchasing this kind of truck, as the route which I travel leads over hilly sections. Now I find that even when the truck is loaded with 3500 pounds the hills cannot be taken unless a change is made to the intermediate and frequently to the low gear. This, of course, causes overheating. The engine seems to have sufficient power when operating on the level, but is weak on grades. I have been advised that the poorly constructed roads over which I run have much to do with this condition. Do you know of any plan whereby I can increase the power of the engine on hills?

No doubt the trouble is that your truck is geared too high for climbing grades on high gear that have a poor road bed. The demonstration was probably made over roads that were in good condition. Would advise that you carefully inspect the motor to determine if greater power cannot be produced. Test the compression of each cylinder, look over the ignition system, tighten all connections, examine carburetor adjustment, gasoline line, etc. If this has no effect on the power, would advise that you attach to the ends of the jack shafts sprockets which have a less number of teeth than those now used. This would afford a greater reduction between the engine and the rear wheels. The speed of the truck would, of course, be decreased, but the power developed would be greater.

LOCATING A NOISY TAPPET.

(F. C. S., Hope Valley, R. I.)

I have a ——— car which I purchased a little over a year ago. When the engine is running there is a peculiar clicking sound which seems to come from the valves in the front block. How can I locate the faulty part?

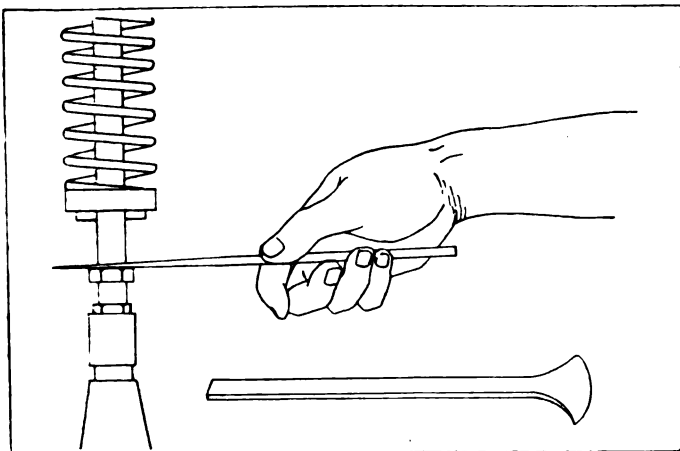
The noise referred to is no doubt caused by a loose or worn tappet. This can best be located when the engine is operating, as shown in the accompanying illustration. Heat and hammer a piece of sheet metal until it tapers to a fine point at the end. While the motor is running insert this tapered end between the valve stem and its tappet, which will form a unit of the two. If the placing of the tool between any valve stem and its tappet causes the motor to run quietly, the faulty member is located. Test each tappet in a similar manner separately until the loose member is located.

ADVANTAGE OF NICKEL STEEL.

(T. R. W., New York City.)

When looking over a few car catalogues, I saw mention of several parts being made of nickel steel. What is this material and what advantage is claimed for it over the ordinary kind of steel?

This metal is frequently used in motor car construction because it contains certain desirable and valuable properties. Among these are resistance to cracking and high elastic limit. In such parts as axles and shafts which are subject to great stresses the higher elastic limit of nickel steel makes for durability and long life.



A Wedge Inserted Between a Valve Stem and Its Tappet Will Form a Unit of the Two and Assist in Locating a Peculiar Sound.

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The instant your car starts—

TRADE MARK
NON-FLUID OIL
REGISTERED

begins lubricating

All common greases, must first *melt* before they start lubricating. Frictional heat must do this melting. Meanwhile your gears are grinding—heating—wearing.

This happens for the first few minutes *every time you start your car.*

But Non-Fluid Oil lubricates every instant the car is in motion. It is a special-process lubricant far superior to grease. Give it just one trial.

In orange-colored cans at *your dealer's*. Write for samples and literature.

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American Trade
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FIRST

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by all
as the
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No 300
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EMERY MFG. CO.
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can be bought at the same price? They overcome all Engine troubles, fire where others fail and Add Power to engine. Any length point desired made to order. Try them and you will use them always. Make a trial and save money. \$1.00 each, 6 for \$5.00.

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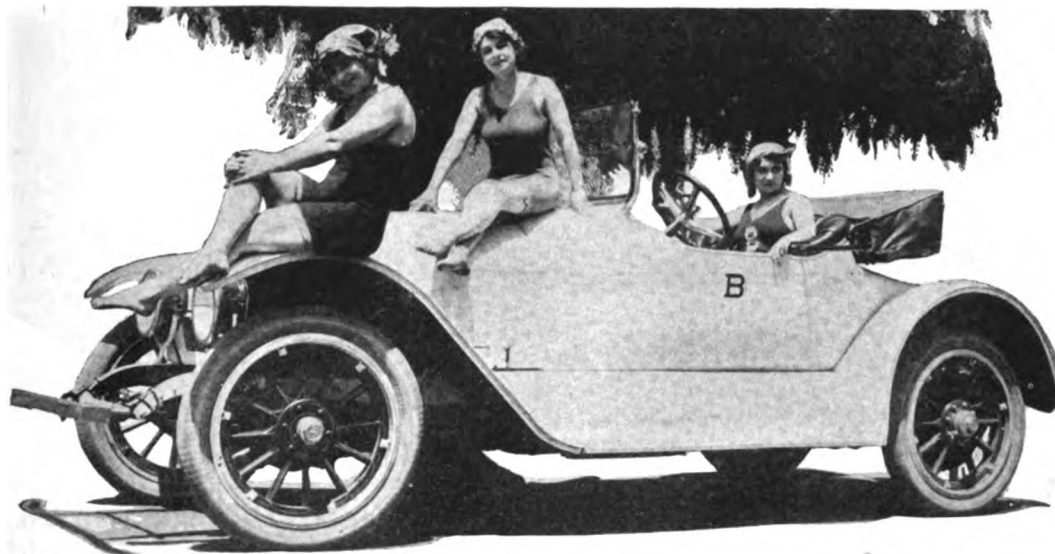
roadster, \$5.95; touring, \$7.95;
Parcel Post Paid:

Others up to \$14; easy to apply. You save 2-3 price of a new top. Ford front springs \$2.30; rear \$6.50. We also build new and repair old auto tops and wheels. Send for catalog and samples of the goods we use in our top roof covers.

SPLIT HICKORY WHEEL AND TOP CO.,
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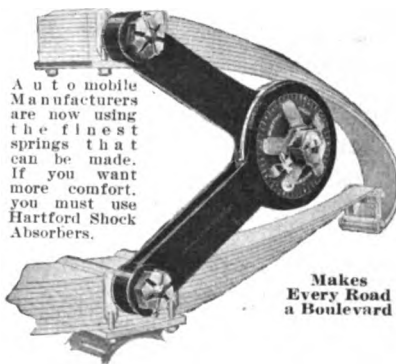
Watch the Cars! You'll See It Everywhere



This car, a Hartford-equipped National Roadster, recently won the first prize at the bathers' parade, Pasadena, Cal. To quote "Motor Age": "The young lady who rode the fender and the young lady who rode upon the hood paid the National a rare compliment by saying that it rode so smoothly and easily that they did not envy the third young lady, who had the upholstered seat." The National is one of many famous cars Hartford-equipped at the factory.

★ **Hartford** SHOCK ABSORBER

Smoothness of motion, however rough the road, gives to motoring its full measure of pleasure. The ride, sans jolt, jar, vibration, is the real joy ride. And the secret of it all lies in making your springs behave. This the Hartford Shock Ab-



sorber does. It controls all their movements, recoil and contraction, so softening and "cushioning" them that the body of the car feels none of the harshness of roughest roadbed. A ride in a Hartford-equipped car is restfully exhilarating.

Safeguard your comfort; protect your car from unnecessary racking. There's one sure way. Hartford equip. Glide; don't bump.

Mention make, year and model of car and we will send you our "Comfort Chart," which tells how to make your particular car doubly comfortable and longer-lived.

EDWARD V. HARTFORD, Inc.,

Heretofore Known as Hartford Suspension Co.

147 Morgan Street

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Makers of the Hartford Shock Absorber, Hartford Cushion Spring, E. V. Hartford Electric Brake, Hartford Auto Jack, Hartford Bumper, Red Rack Jack.

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Distributors in principal cities. Dealers everywhere.



It's the same old COES

How often have you heard the repairman, machinist or shop manager say, "It's the same old Coes, just as good as the day I bought it—it will last forever."

That is evidence of the quality that has made Coes wrenches the standard the world over.

Coes Wrenches made today are just as good as the Coes Wrenches produced 50 years ago.

The material is selected with the same care, made by equally experienced and trained wrench makers, in a factory which specializes in wrench making. The wrenches are finished carefully and many times tested to assure the quality that will meet every requirement placed upon them.

Car owners who know wrench values demand the Coes. It is most popular with automobile repairmen, and in every other line of mechanical work Coes Wrenches will be found on the benches and in the tool kits of the expert workmen.

Coes wrenches can be had in just the size to fit any use. Any Coes will afford the same long and satisfactory service. It is always dependable and from the standpoint of wrench service it is the cheapest wrench produced.

Coes wrenches are sold wherever motor cars are used. They may be had of all jobbers, automobile supply houses, and automobile and hardware dealers.

Catalogue on request.



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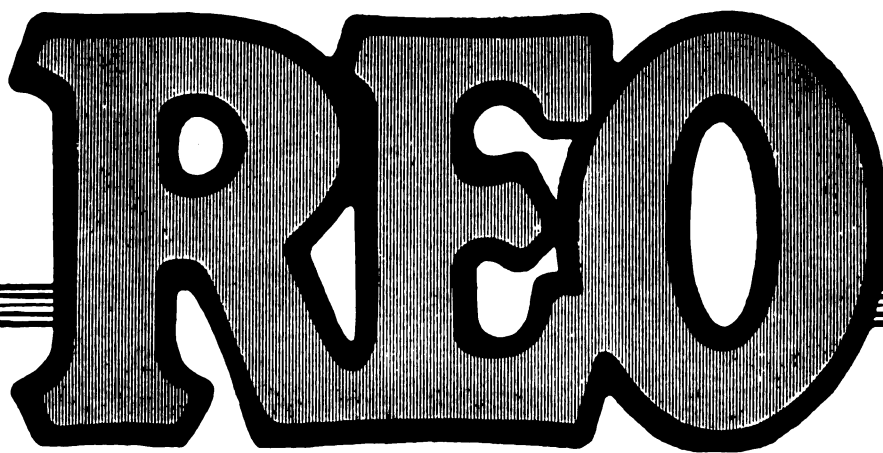


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Does Exclusive Representation Pay?

IF ANYONE WERE TO ASK YOU to name the dealers throughout America who have been the most successful—have made the most money and kept it, have made for themselves the best places in their respective, and who are looked up to as men of standing and integrity as well as of wealth,

YOU WOULD NAME THE MEN and the concerns that have, from the very first, handled Reo cars—and those who have handled one other make.

YES, YOU NAMED THE OTHER—first time. No need for us to do it here. It sells for about twice the average price of the two Reos, and its standing in its class is similar to that Reo enjoys in its class.

BUT WE WERE SAYING: If you were asked to name the most successful automobile distributors and dealers in this country, you'd name those who have, from the first, handled one of those two lines exclusively. And the next most successful are those who have handled the two lines—Reo and the other—together and to the exclusion of all others.

65 PER CENT OF THOSE who handle Reo cars and Reo motor trucks now, handle this line exclusively—and they are successful all. No exception to that rule.

AND YOU'LL FIND TOO that those dealers who have from the first, consistently handled the other line exclusively are also successful—far beyond the average of dealers generally. You see, we Reo Folk can afford to be fair. We can afford to admire the right kind of competition—in fact, there are no more enthusiastic admirers of an honest product and fair competition than we Reo Folk.

NOW THE AVERAGE DEALER THINKS that it's a clever scheme to handle an extra "long discount" line or two—for trading, etc. He thinks it clever to use a line like Reo to bring the customers in and then, by subtle innuendo, to substitute the other on which he gets perhaps 40 per cent.

HE THINKS IT CLEVER to have some other line to slip in when the demand for Reos is greater than the possible supply—he thinks he is making money by not losing sales.

ALL RIGHT. BUT HAVE YOU EVER KNOWN such a dealer to make any real money or to achieve a real standing in his territory? If there are any such they are exceptions to the rule. They may make money this year—only to lose it next.

BECAUSE, YOU SEE, they have to spend on the other car all the money they make on Reos—in "free service" to the buyer. Such a car is generally a new and untried model. Or it is made by an assembler with little or no financial backing or responsibility—and sooner or later it is up to the dealer to make good.

IN THE END HE LOSES both the money he has made selling Reos and the reputation his handling of Reos has given him.

SO YOU SEE IT DOES PAY to handle a first-class line exclusively.

(139-A)

REO MOTOR CAR COMPANY Lansing, Mich.

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*This Same
Stamina
in All Models
of the
**STURDY
STUTZ***

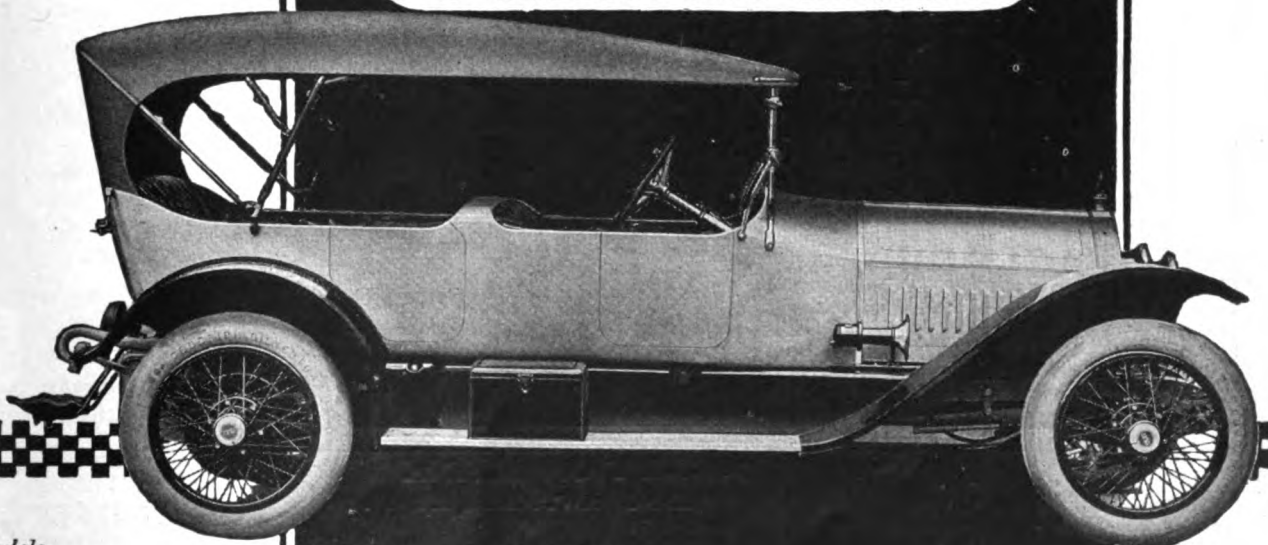


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Speedway Champion

WORLD'S
Road Race Champion

World's Long Distance
Records 250; 300; 350 mi.

World's Record for Consistency
4 Consecutive 1st & 2nds



Five Models
\$2,000—\$2,550

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are unequalled for motor lubrication, freer from carbon, economical because they protect the motor against mechanical wear, and the quantity required is comparatively small.

These are the claims of thousands of motorists,—some with years of experience,—who want full value, and more who know the value of high grade lubricants, and who know when they obtain satisfaction.

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A grade for every type of motor.

It is sold in sealed containers

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AND SUPPLY CO.**

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60

Automobile Builders Prefer Spark Plugs

Each AC Spark Plug is subjected to 150 lbs. air pressure, as shown above, to assure it's being "gas-tight."

A C Spark Plug supremacy has been established not only by severest tests under the personal direction of critical experts, but by an efficiency in every day performance that instantly wins favor of every car owner. Sixty of the leading automobile manufacturers, to whom efficiency must be proven, acknowledge the A C as the standard spark plug of America and give it their overwhelming preference, staking their prestige upon its performance.

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Dort	McFarlan	Crane-Simplex
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Oakland	Glide	Wilcox Trux
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A C Spark Plugs are in greatest demand on account of their proven supremacy, and, therefore, are a better business-getter for dealers than all other makes combined. Special Plugs for Ford, Overland and Studebaker motors, insuring highest efficiency.

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Flint, Michigan

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D. O. Black, Jr., Secretary.
Times Building, Pawtucket, R. I.

Entered as second class matter, April 15, 1906, at the Postoffice at Pawtucket, R. I. under Act of Congress of March 3, 1879

VOL. XLII.

MAY 25, 1916.

NO. 8.

The Publisher's Comments.

CROSSING the Continent in a motor car in 150 hours, as one hardy driver did recently, is a feat that few car owners care to emulate, they finding a greater degree of pleasure in touring among the country's scenic and historic grandeurs in a more leisurely manner. June, the month that usually marks the beginning of vacation period, is almost here, and at this time there is a much larger number of motorists looking forward to motor tours than there ever was before. Have you planned your first tour of the season? If not, address your inquiries to the Touring Editor, who is prepared to answer promptly and fully any question pertaining to motor tours in any part of the country.

It is During July that the majority of motorists start out on the longest tours of the season, and it is also in that month that the Annual Touring Number of The Automobile Journal is issued—July 10. This number will contain information that will enable anyone to plan a tour in any part of the country, showing unusually complete itineraries, route maps and tables of mileages in either direction and between towns and cities. By means of the Index of Tours, a feature that alone is worth the price of a year's subscription, it is possible for a tourist to start from any given point and arrive on scheduled time at any destination in the United States and Canada.

The Next Motor Race of importance is to be held at Indianapolis. The news available up to within a few days of the start is told in the leading article of this issue. The results will be published in detail in the following number, June 10, wherein also will be an analysis of the records and equipments of the contesting cars. There is valuable information to be obtained by close study of the equipments of racing machines. Of necessity the drivers use only the best, both as regards qualities of endurance and of service. In most instances the equipments used on racing cars are standard throughout the industry and are sold in the largest volumes.

The Car Owner's Letter published in the April 25 issue has aroused much interest among motorists and road builders in various parts of the country. The writer brought out several truths that found echoes in the hearts of many taxpayers, and were the means of awakening them to the conditions in their localities. Letters of this kind, those that are constructive and discuss some subject that is close to the interests of motorists, are always welcomed by the Editor.

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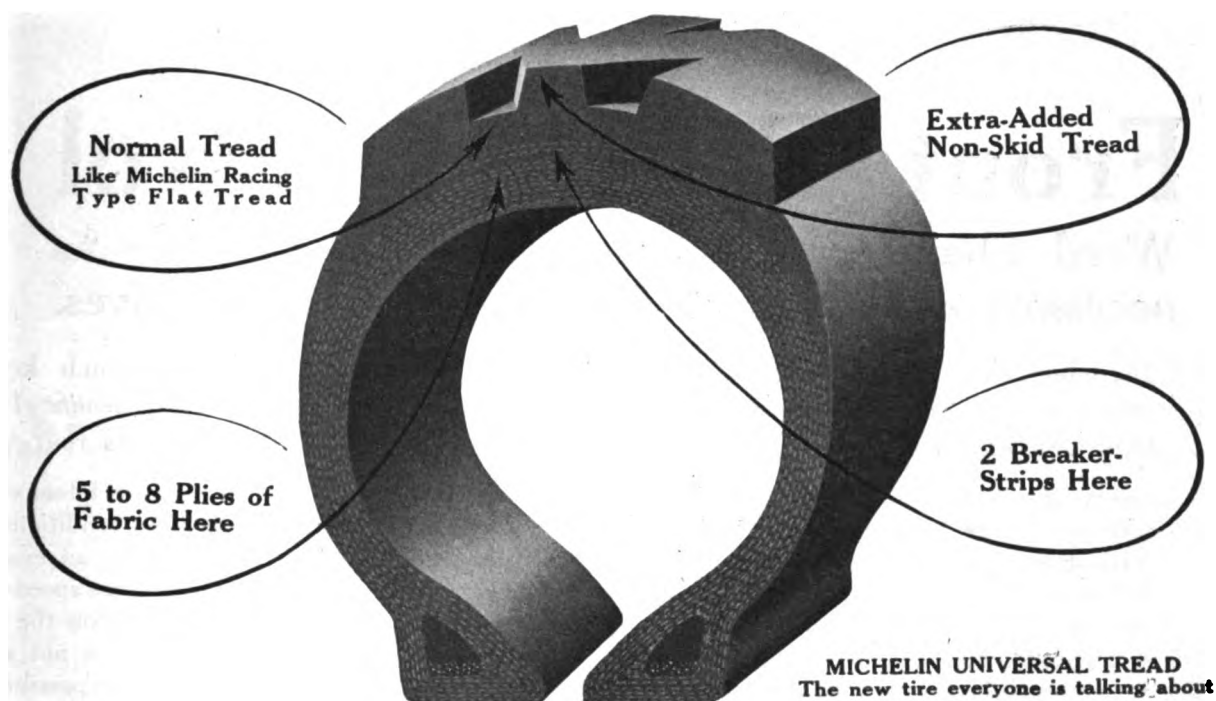
ONE QUALITY ONLY—THE BEST

MICHELIN

12 to 15% Extra Weight

When you buy your next tire make this simple test. Have your dealer weigh a Michelin Universal Tread in comparison with all other non-skids of the same size. You will find the Michelin 12 to 15% heavier than the average, the exact percentage depending on the size of the tires used in this test.

This extra weight represents extra rubber and fabric, which means extra service.



Examine the above cross-section of the Michelin Universal Tread—or better still, ask your dealer to show you a cross-section of the tire itself. Notice the remarkable thickness of rubber, the numerous plies of fabric and the double breaker-strips—all evidences of superior durability.

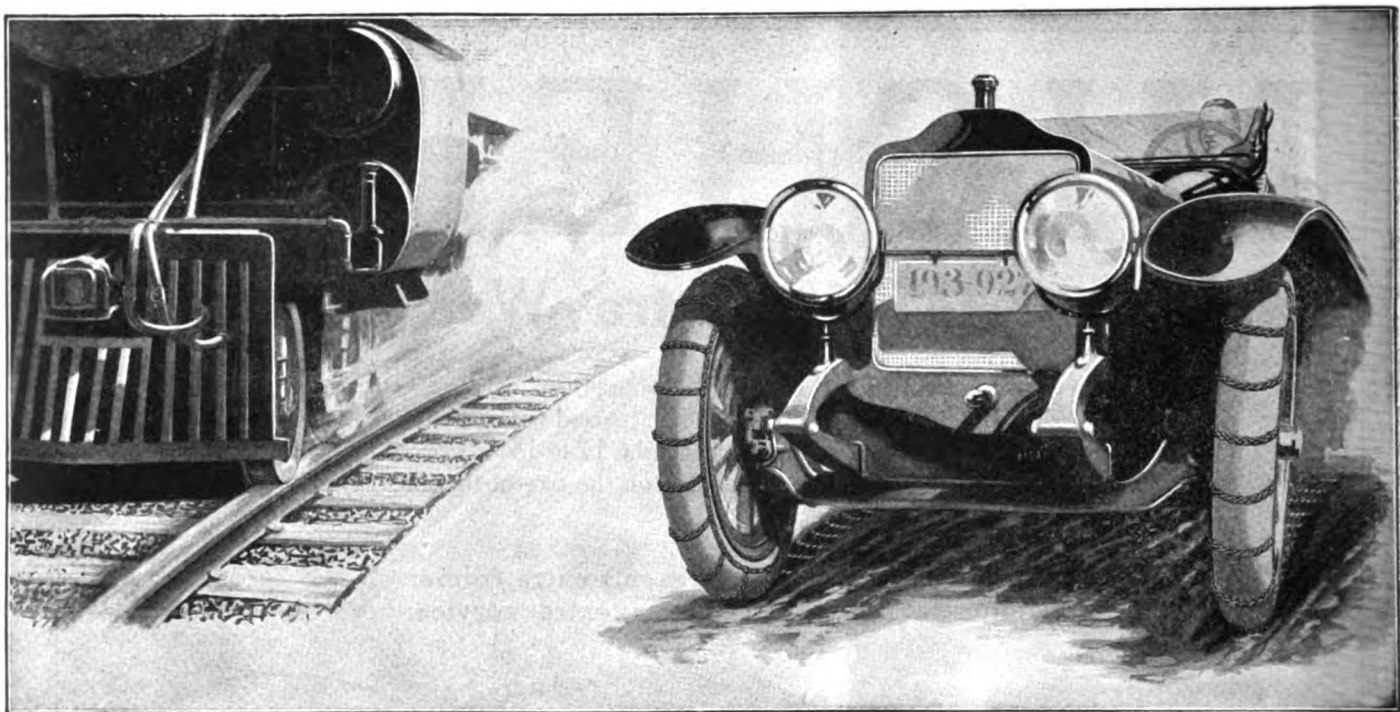
As a conclusive test, and in justice to yourself and to us, try just one Michelin Universal Tread Casing in comparison with other makes, keeping record of the extra mileage that it gives you. Once you make this test we feel sure that you will use Michelins exclusively.

NOTE TO DEALERS: There are thousands of loyal Michelin dealers throughout the country, but in your territory Michelin may not be adequately represented. If so, a real opportunity awaits you. Write for full information.

MICHELIN TIRE COMPANY — MILLTOWN, NEW JERSEY

MICHELIN—FOUNDED—1832

(When Writing to Advertisers, Please Mention The Automobile Journal.)



Front Wheel Control

Weed Chains on front tires of motor cars are as necessary as flanges on front wheels of locomotives.

The front wheel skid is the greatest cause of the many automobile accidents which keep the newspaper columns sprinkled with harrowing accounts. Appreciating this fact *The Scientific American* in the following editorial advocates the use of Tire Chains on the front as well as rear wheels:

"The majority of automobile owners fit chains to the rear wheels only, and appear to consider this ample insurance against accidents from skidding, but this practice is a doubtful economy, for, although the rear wheels, thus armed, may hold the road fairly well, the really bad accidents too often result from the inability of the driver to control the course of his machine. Any old bicycle rider knows that he can retain the control of his machine and maintain his balance when the rear wheel skids badly as long as the front wheel holds its

grip on the road, but that he becomes helpless whenever the front wheel slides. The same conditions are true in the case of the automobile, but in an exaggerated degree, for its weight and the average speed both tend to make the grip of the front wheels on the road precarious, and a skidding front wheel is not much different from a broken steering gear in the possibilities of disaster. Recognizing these facts, it is apparent that chains are fully as necessary on the front wheels as on the rear."

To use Weed Chains only on rear tires means to have your car only half protected. Put Weed Chains on all four tires at the first indication of slippery going and you will have quadruple protection against injury, death, car damage and law suits.

Weed Chains Are Sold for All Tires by Dealers Everywhere

AMERICAN CHAIN CO. INC., BRIDGEPORT, CONN.

Sole Manufacturers of Weed Anti-Skid Chains

In Canada—DOMINION CHAIN CO., Ltd., Niagara Falls, Ontario.



(When Writing to Advertisers Please Mention The Automobile Journal.)



On the Eve of the Great International 300-Mile Contest, Indications Are that this Race will Be the Greatest Ever Held in Indianapolis.

Sixth Indianapolis Sweepstakes.

THE conditions under which the Memorial Day race at Indianapolis is to be run are much changed since the previous races, but it is apparent from the entries that it is to remain one of the greatest, if not the greatest, track event of the speedway season.

Speedways have multiplied since the Indianapolis track pointed the way and this year instead of being the first national event on the programme, it is second, the first having been held at Sheepshead Bay, May 13. This year's race for the first time will be 300 instead of 500 miles, and the prize money has been reduced to \$30,000 from \$50,000.

In addition to these difficulties is the fact that the European manufacturers, who have been the leading racing car builders, have been too busily occupied to give their attention to speed cars and, with one or two exceptions, the American makers have shown little interest in the races—or at any rate, not sufficient to build special cars and enter them.

Nevertheless, three of the best known European racing car makers will be represented. Two, the Peugeot and Delage, by cars designed before the war, and one, Sunbeam, by a new car fitted

with a six-cylinder engine, developed after much experience on aeroplane motors. There will also be some very interesting new American cars of the high speed, four-valve type. These will include the new productions of the Premier Motor Car Corporation, developed by Engineer Yarian, who has had aeroplane experience, three Frontenac cars, built by Louis Chevrolet to meet his views of racing engineering, and two Crawfords, which use the well known Duesenberg motor, are entered by a New York millionaire.

Practically all the well known American drivers, except Ralph De Palma, are included in the list, which contained 30 entries when it closed May 1. Last year there were 41 entries in all, but these were reduced in the elimination trials to 25. This year, if the preliminaries prove so rigorous, or if some of the cars are unable to recover from the usage they were subjected to in the Sheepshead Bay race, the field of starters may be considerably smaller. Thirty entries in all were made.

There will be four Peugeots in the race. Three of these are entered by interests controlling the Indianapolis speedway, and they will be driven by Aiken and



The Electrical Timing Apparatus by Which Exact Records of the Various Cars Are Made—This Apparatus Does Not Vary More Than .06 of a Second in Accuracy.



Howard Marmon, Referee and Chief Engineer of Nardye-Marmon Company, Manufacturer of the Marmon Car.

and presented to Barney Oldfield, the veteran driver. Lewis and Johnson are the drivers of two Crawford cars. These were built at the factory of the Crawford Motor Car

Merz, old National stars, and by Ralph Mulford. The fourth is Resta's, last year's runner-up. He has been to Europe during the winter to secure all the parts that are necessary to make the car as good as new.

Three Delages, designed like the Peugeots, for the Grand Prix races preceding the war, will take part. Two of them are entered by Harry Harkness, one of the backers of the New York speedway, and their drivers will be Le Cain and a man yet unnamed. Limberg, one of the team, wrecked his car and was killed at Sheephead Bay. The third is an exactly similar car purchased by David Joyce of Chicago

and presented to Barney Oldfield, the veteran driver.

Lewis and Johnson are the drivers of two Crawford cars. These were built at the factory of the Crawford Motor Car

during the winter and more speed is expected from them than they have ever given before. They are entered by the Prest-O-Lite Company.

Another team which has always given a good account of itself is the Duesenberg. Eddie O'Donnell, with this car, won the greater share of the glory in the early events on the Pacific Coast. A new engine has been designed with four overhead valves similar to that which proved so successful on the Stutz last year. Its performance will be a matter of great interest to engineers.

The other entries include two Erwin Specials, built in Philadelphia and driven by Stecher and Grover Bergdoll, an Osteweg Special, driven by S. Osteweg, and an unnamed car with an unnamed driver from Cleveland.

From this list of entries there are two conspicuous absentees—Ralph De Palma, and the Mercedes car which won the race last year, and the Stutz team. True to the announcement of Harry Stutz that his team would not appear again until its record had been broken, they are not scheduled.

Another maker has stepped in to fill the place of Stutz, or try to fill it, and this is the Premier Motor Corporation. It has designed three special racing cars with four cylinders and four overhead valves for each cylinder. They will be driven by Tom Rooney, formerly of the Stutz team, Gil Anderson and Harry Stillman.

De Palma Sells His Mercedes.

After the entries closed Ralph De Palma wrote a letter to the speedway officials, saying that he had sold his Mercedes to J. B. Book, an amateur driver of Detroit, who wished to drive in the race and asked that he be allowed to make a late

FIVE PREVIOUS RESULTS.

The five previous Indianapolis sweepstakes races run at Indianapolis resulted as shown in the following table. Each was for 500 miles instead of 300, as is the case this year, and the prizes totaled \$50,000 instead of \$30,000. In the first two races the engines were limited to 600 cubic inches piston displacement, in the next two to 450 inches displacement and last year to 300 cubic inches, which limitation applies this year:

Car	Driver	Time	M.P.H.	Car	Driver	Time	M.P.M.
1911				Stutz	Charles Merz	6:48:49	73.38
Marmon	Ray Harroun	6:42:08	74.59	Sunbeam	Albert Guyot	7:02:58	70.92
Lozier	D. Bruce Brown	6:43:51	74.29	Mercedes	Theodore Pilyette	7:20:13	68.14
Fiat	Ralph Mulford	6:52:29	72.73	1914			
Mercedes	Spencer Wishart	6:52:57	72.65	Delage	Rene Thomas	6:03:45	82.47
Marmon	Joe Dawson	6:54:34	72.34	Peugeot	Arthur Duray	6:10:24	80.99
1912				Delage	Albert Guyot	6:14:01	80.20
National	Joe Dawson	6:21:06	78.70	Peugeot	Jules Goux	6:17:24	79.41
Fiat	Teddy Tetzlaff	6:31:28	76.60	Stutz	Barney Oldfield	6:23:51	78.15
Mercer	Hughie Hughes	6:33:09	76.30	1915			
Stutz	Charlie Merz	6:34:40	76.00	Mercedes	De Palma	5:33:55	89.84
Schacht	Bill Endicott	6:43:28	73.30	Peugeot	Resta	5:37:27	88.91
1913				Stutz	Anderson	5:42:27	87.6
Peugeot	Jules Goux	6:35:05	75.92	Stutz	Cooper	5:46:19	87.11
Mercer	Spencer Wishart	6:52:57	72.65	Duesenberg	Alley	6:15:08	79.33

Company, Hagerstown, Md., and are equipped with Duesenberg motors.

Much is expected from the new Sunbeam entered by Joseph Christiaens, the well known Belgian driver, who has previously competed at Indianapolis. This car was built by Louis Coatalen, the Sunbeam engineer, to try out in a racing car some of the things his experience with aero-plane engines has taught him since the war began.

Chevrolet Builds Three Cars.

The ideas of Louis Chevrolet, the well known racing driver, on fast car design, have been incorporated into three Frontenac cars built by him during the winter. These will be driven by Louis, Gaston and Arthur Chevrolet.

Eddie Rickenbacher, winner of the Metropolitan Trophy contest, and who made a remarkable record last year by his daring driving in the less prominent speedway events, will captain a team using two of the Maxwell cars which were on the track last year. They have been thoroughly overhauled

entry. It is not possible to grant a request for so late an enrollment without the consent of every entrant, who was in on time, but requests for such consent were at once sent out. If



Jack LeCain in the Delage in which he is expected to make an excellent showing at Indianapolis

CONTESTANTS IN SIXTH RACE.

Driver	Car
1.....Oldfield	Delage
2.....Aiken	Peugeot
3.....Merz	Peugeot
4.....Mulford	Peugeot
6.....Le Cain	Delage
7.....Not Named	Delage
8.....Du Chesnau	Du Chesnau Special
9.....Lewis	Crawford
10.....Johnson	Crawford
11.....Not Named	Duesenberg
12.....Joseph Christiaens	Sunbeam
13.....A. Chevrolet	Frontenac
14.....G. Chevrolet	Frontenac
15.....E. Rickenbacher	Maxwell
16.....Henderson	Maxwell
17.....Rooney	Premier
18.....Bergdoll	Erwin Special
19.....Not Named	Not Named
20.....Dario Resta	Peugeot
21.....Gil Anderson	Premier
22.....Harry Stillman	Premier
23.....Louis Chevrolet	Frontenac
24.....Not Named	Sunbeam
25.....S. Osteweg	Osteweg Special
26.....Tom Alley	Ogren Special
27.....Billy Chandler	Crawford
28.....Stecher	Erwin Special
29.....Eddie O'Donnell	Duesenberg
30.....D'Alene	Duesenberg

the car goes in it is expected that De Palma will figure as relief driver and will do the driving. The failure to enter earlier is said to have been due to inability to get the car in shape in time.

There are good reasons for thinking that this year's race will be one of the best ever seen at Indianapolis. The cars entered are as fast or faster than any that have ever been entered. The reduction of the distance by 200 miles should make it possible for a car to stand a greater speed for the full length of the race without wearing out and going to pieces.

Because of the construction of the track much more depends on the driver than on the wooden saucer tracks. There, after the car is started, it drives itself almost automatically, so to speak, but the brick track at Indianapolis makes it necessary to handle a car with much judgment in rounding the curves and taking the straightaway. It is much easier for the cars to pass each other. Something over 90 miles an hour for the race is expected if conditions are good.

The result of the race at Sheepshead Bay, which was won by Rickenbacher in his remodeled Maxwell, makes him a favorite in the Indianapolis classic. Rickenbacher has been known as a daring and extremely skillful driver, who often takes chances a shade more dangerous than most of the drivers are willing to attempt.

It is this quality of his driving which enabled him last

year to win so many of the dirt track and other events on one-mile speedways, where the nature of the course reduced the speed possible for the fastest cars and left the victory for the driver who was able to drive with the greatest daring and skill.

His skill in this respect was shown at Sheepshead Bay when Limberg's car struck the rail and was wrecked, killing its two occupants. The car broke in two and rolled down the track, with Rickenbacher coming hard just behind, and it was necessary for him to pick a way between the two falling parts of the car.

He had still 120 miles to drive after this great nervous shock and did it so well that he won the Metropolitan race.

The two Maxwell cars which make up the Presto-Light team, have been redesigned to provide a larger valve lift and improve the manifold design, so that the speed has been considerably increased over what they were capable of last year. The spark plug trouble which affected them in some of the races last year has also been removed.

Christiaens is expected to have his car, a new six-cylinder Sunbeam, in better shape than it was at Sheepshead Bay, where he burned out a bearing after driving a few miles. Eddie O'Donnell, whose record in the Pacific Coast races was imposing, did not start at New York, nor did Barney Oldfield, who, with his new Delage, believes that he has an excellent chance of winning the classic, which he says will be his last race.

One of the extremely interesting features of the big races for the technically inclined is the electrical timing apparatus that is used to keep track of the cars. This is known as the Stewart timing machine and a single installation costs several thousand dollars.

When a car crosses a certain line on the track, the circuit is broken and this causes the electrical mechanism to stamp the time in fractions of a second. It is arranged so that the front wheels affect the timer, but the back wheels do not. Yet two cars crossing very close together are registered separately.

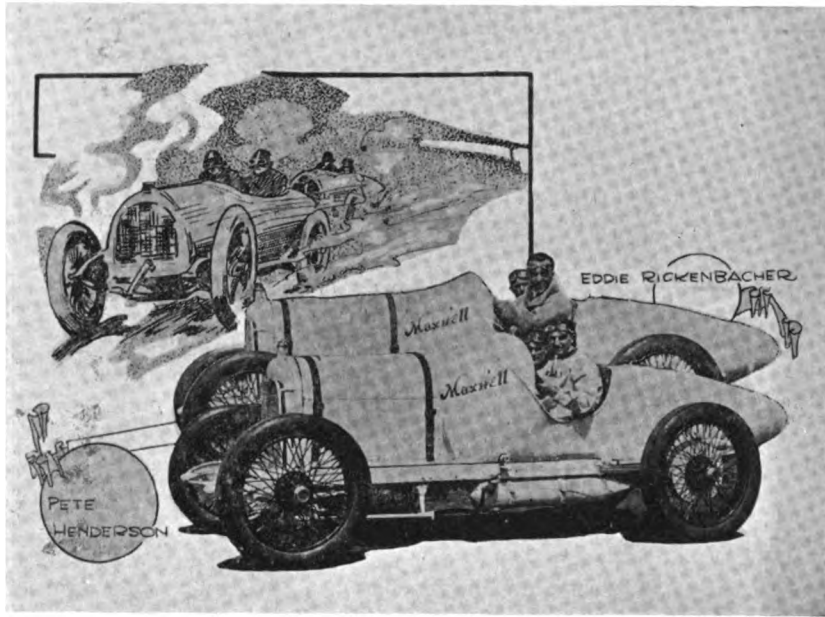
As the cars pass, two observers call out their numbers, which are noted by a clerk on the tape next to the time stamp, showing when they crossed. There is a checker to see that the correct numbers are called and another to see that the clerk enters them correctly on the tape. A very



George M. Dickson, Starter and General Manager of the National Motor Vehicle Company.



The Team of Crawford Cars, Which Are to Be Handled at Indianapolis by Dave Lewis, Art Johnson and Billy Chandler.



“The Prest-O-Lite Team, Rickenbacher and Henderson and Their Maxwell Cars—Rickenbacher Is in the Car with Which He Won the Metropolitan Trophy at Sheepshead Bay.

high grade chronometer is connected with the time stamping mechanism, which it corrects, so that it is impossible for the time to be more than .06 seconds incorrect.

HAMMOND BETTERS BAKER'S RECORD.

E. G. Baker's transcontinental record of 7 days, 11 hours and 52 seconds from San Francisco to New York City endured just eight days. In the afternoon of May 23 Bobby Hammond, at the wheel of a stock Empire car equipped with a special racing body, drove into New York City, having been on the road from San Francisco for 6 days, 10 hours and 59 seconds.

The route followed by Hammond, the Lincoln Highway, proved 87 miles shorter than that over which Baker drove his Cadillac. The total mileage of each was 3384 and 3471 miles. Baker's trip is described on another page.

During the trip Hammond slept only 12 hours. He did all the driving himself, and even then “wore out” two observers, one Harold Bell, being bounced out of the car and one of his arms being broken.

The fact that the Sierras were covered with a deep layer of snow is partly responsible for the new transcontinental record. Finding the roads impassable, Hammond followed a train through a snow shed, bumping along with one wheel between the rails for about 40 miles. This manoeuvre made it possible to complete the first leg of 917 miles to Ogden, Utah, in 36 hours, practically without a stop. It was near Chey-

enne, Wyo., that Hammond “lost” his first passenger.

The best run—about 700 miles in 17 hours—was made between Omaha and Elkhart, Ind. At this point Hammond took his first protracted nap. At Sandusky the driver was nearly decapitated by a tire pump, which a man for unknown reasons hurled at the car. The pump just missed the motorists' heads, but struck and cracked the pole bearing an American flag at the rear of the car. Hammond did not stop to make inquiries—he was out for a record.

At Canton, O., torrential rains fell and the car for several hours made not much better than two miles an hour. A head-on collision occurred at Pittsburg, without much damage to the Empire. At Newark, N. J., Hammond was held up for reckless driving, and despite the fact that he carried a sign at front and rear of “U. S. Mail,” it cost him \$20 as bail. The sign was carried because Hammond was transporting a bag of mail from Mayor Rolfe of San Francisco to Mayor Mitchell of New York City. It is said that this is the first time that an automobile has officially carried mail across the country.

At the finish all four cylinders of the car were still working perfectly, and the only injury to the chassis was a cracked spring. Throughout there was only one tire change necessary, though the tires were punctured 70 times. These were quickly repaired with Bales patent tire pluggers, which Hammond called his only “life insurance.”

Hammond was not entirely satisfied with his trip. “I'd set my heart on doing this in five and a half days,” he declared modestly, “and if anyone starts bothering this record, by jingo I will.”

KING NOT EFFECTED.

The King Motor Car Company advises that the report recently circulated that the Detroit Morgan & Wright plant had been largely added to by the purchase of buildings now occupied by the Michigan Steel Boat Company and the King Motor Car Company, is very misleading with reference to the latter concern and is detrimental to its business interests.

While the boat company's lease may expire next January, as reported, the lease held by the King company has many years yet to run and the plant of the company consequently will in no way be disturbed by the Morgan & Wright purchases before the King company has had ample time to locate or construct buildings of an area sufficient for its rapidly growing business. Though the company had already acquired 70,000 square feet elsewhere in the latter part of 1915, its business has outgrown this addition.



Birdseye View of the Indianapolis Speedway, Scene of the Sixth International Sweepstakes, May 30—Acreage, 328; Number of Buildings, 43; Length of Row of Grandstands, One Mile; Seating Capacity, 75,000; Total Capacity, 250,000.

FAST TIME MADE AT CHICAGO.

Amateurs Show Championship Form—Clean Sweep Made by Two Mercer Cars in Both Races.

William A. Leet of the Omaha Automobile Club and Al Schillo, Chicago dealer, both driving Mercer cars, won the amateur races at the Chicago Speedway, May 21, and each is now acclaimed as the champion nonprofessional and the champion driving automobile dealer of the Middle West. Though amateur drivers, the contestants made remarkable speed, Dr. R. R. Duff making one lap in the Interclub race at the rate of 94 miles per hour. The record for this course is held by Dario Resta, the professional, who averaged 101.86 miles per hour last year in the Challenge 100-mile race.

The Interclub race was for a distance of 30 miles, which was made by the winner in 20 minutes and 44.3 seconds. The dealers' race was for 50 miles and the time by Al Schillo, the winner, was 34 minutes and 35.1 seconds. There were no fatalities and few mechanical troubles.

A. A. A. FOR RECIPROCITY.

The American Automobile Association is now endeavoring to secure the passage of the Adamson bill before the conclusion of the present session of Congress. About 3,000,000 motorists are interested in this bill, which, briefly stated, gives the owners of motor vehicles the same interstate rights possessed by owners of animal drawn vehicles. In effect it advocates the open door policy now in force in New York state, which offers to motorists of other states reciprocity for whatever period provided for by the state in which the motorist resides, for one day or the entire 365 of the year.

When Representative W. C. Adamson of Georgia, who is father of the bill, introduced the measure a year ago, he did so because he considered its provisions simply common sense and because he believed it was discrimination to forbid the motor propelled vehicle the rights possessed by animal drawn vehicles. It is expected that eventually the automobile and commercial truck will have entire freedom of the highways of the country in interstate traffic of all kinds.

WARD IN DEFENSE SOCIETY.

Artemas Ward, Jr., president of the King Motor Car Company, Detroit, has been selected as a member of the national committee of the American Defense Society, the purpose of which is to aid in an aggressive propaganda in various states for creating yearly instruction camps of rudimentary training in schools and an adequate citizen soldiery for defensive purposes only. Mr. Ward has accepted the portfolio.

The advisory board of the society consists of Charles J. Bonaparte, Truman

H. Newberry, Henry B. Joy, Theodore Roosevelt, Perry Belmont and David Jayne Hill.

ANOTHER RECORD FOR A C PLUGS.

One of the points brought out by E. J. Baker, driver of the Cadillac car on the transcontinental journey, described on another page, was that his motor functioned perfectly throughout the 3471 miles. This is one of most remarkable performances in speed and endurance of the year, and speaks well for the A C Titan spark plugs with which the car was equipped. Not once during the drive did these plugs give the slightest trouble according to Mr. Baker.

"ROAD OF ENCHANTMENT."

In San Mateo county, Cal., there is a stretch of highway that bears the name of the "Road of Enchantment" because of its wonderfully beautiful scenic surroundings and smoothness of surface. It lies between Woodside and La Honda, on the way from San Francisco to the seaside, and until recently was one of the most difficult routes in the whole state.

The road has been graded and surfaced, and will be opened to the public about June 15. A month before this though an old time KisselKar, which is shown in the accompanying view, was allowed to make the pioneer trip over the route. A Californian writer describes this road as perfect: "Automobile tourists will find that the charm and beauty of the new La Honda road so far surpasses the old that efforts at comparison will be immediately dismissed. It is of an average six per cent. grade, is made up of long, easy open view, graceful curves, and the road surface is oiled macadam."

The length of the "Road of Enchantment" is 7½ miles, and its curves have been so carefully laid out that the actual running time between San Francisco and La Honda,

or San Gregoria, will be equivalent to a shortening of from eight to 10 miles. The grades are so easy that it is said the trip from San Francisco to the seaside can be made all the way on high gear.

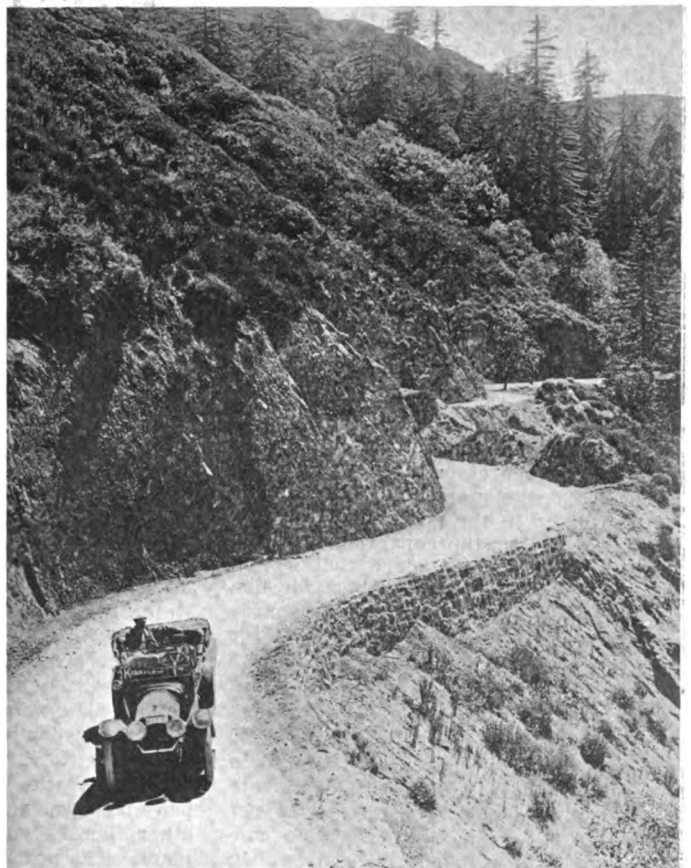
GOVERNOR SIGNS NEW BILL.

Governor Whitman has signed the Brown committee bill which provides that motor vehicle registration fees shall be divided equally between the counties in which they are collected and the state at large. This means that the burdens of taxpayers in New York City will be lightened to some extent.

Funds received from last year's registrations amounted to \$1,913,175, and of this New York City contributed \$677,399. For the current year the receipts are expected to amount to more than \$2,500,000. Under the new law the up-state counties' shares must be devoted to highway work, while Greater New York share is to be turned into the general city fund. Under the old statute all such moneys were used for state highway purposes.

H. A. L. TWELVES ARE SHIPPED.

The H. A. Lozier Company has begun shipment from Cleveland of the new H. A. L. 12's. A number of dealers have driven their cars away because of congested freight conditions. Traveling by road, some of them went as far as New York and Boston.



A Stretch of the "Road of Enchantment" Over Which a Kissel-Kar Made the Pioneer Trip.

Willys Re-Elected Head of Overland.

**All Officers Were Returned to Office—
Par Value of Common Stock Has
Been Reduced.**

At the annual meeting of the stockholders of the Willys-Overland Company, held at the Toledo factory, May 9, John N. Willys was re-elected president and all the other officers were returned to office, they being H. T. Dunn, H. L. Shepler, Isaac Kinsey and C. A. Earl, vice presidents; Walter Stewart, treasurer, and Royal R. Scott, secretary. The board of directors will consist of the officers mentioned and also James Kepperly and Rathbun Fuller.

Heretofore the Overland fiscal year ended on June 30, but since the new by-laws adopted last fall went into effect it now ends Dec. 31. Hereafter the annual meeting will be held the second Tuesday in May.

The report of the sales department formed one of the most interesting features of the meeting, that department indicating not only very satisfactory results for the past 12 months, but excellent prospect of an increase proportionate to that of the last year. The shipments for the 12 months ending April, 1916, showed an increase of 174 per cent.—137,665 automobiles, as against 50,258 for the preceding year. The largest single month's shipments this year amounted to 19,781 cars, as compared with 7005 for the largest month of the previous year.

At the close of business on May 1, 1916, the company had orders on hand for 11,301 cars, as against 4527 on order May 1, 1915. Total exports of all models for the 1915 season was 2331, whereas up to May 1, 1916, export sales totalled 9867 cars, with unfilled orders on hand for 977 more. Had it not been for a lack of ocean shipping facilities it is thought that the foreign total could readily have been increased by 2000 cars.

The directors have authorized a reduction in par value of the common stock from \$100 to \$25 and the reduction has been approved by the secretary of state of Ohio. It is understood that the plan will become operative about June 1.

It is believed that stockholders will receive four shares of the new stock for each share they now hold. No change will be made in the position of the preferred stock, but the conversion ratio is automatically readjusted so that during the conversion period, which is for five years following Jan. 1, 1917, three shares of the preferred may be exchanged for four shares of the common stock.

The Willys-Overland company has outstanding \$15,000,000 seven per cent. convertible preferred stock and \$21,000,000 common stock. It has been rumored in financial circles that the dividend rate would be increased from six to 10 per cent. per year, though there is no confirmation from authoritative sources. In 1914 the stock of the company sold as low as 58. At the middle of May it stood

around 276, a new top mark for this stock.

MAXWELL DIVIDENDS UNCHANGED.

The Maxwell Motor Company, Detroit, has declared its regular quarterly dividend of 1½ per cent. on its first preferred stock, payable July 1 to stock of record June 9. No action was taken on the inauguration of dividends on second preferred stock. O. F. Weber, who has been assistant general manager, was made a vice president.

CROOKER JOINS CHALMERS.

A recent addition to the advertising staff of the Chalmers Motor Company, Detroit, is Robert H. Crooker, assistant advertising manager. Before joining Chalmers, Mr. Crooker was advertising



Robert H. Crooker, Assistant Advertising Manager, Chalmers Motor Company.

manager of the Regal Motor Car Company. In other fields he spent seven years on the staff of the Detroit News, leaving that connection to edit the house organ, sales bulletins and other publications of the Burroughs Adding Machine Company.

ORDERS 357,000 A C PLUGS.

As an instance of the huge increase in the business of the Champion Ignition Company is the recent order for 357,000 A C spark plugs placed by the Motor Car Equipment Company of Boston and New York. This is understood to be the largest single order ever given for spark plugs, and betters the order for 300,000 recently placed by the Beckley-Ralston company.

The sale of A C plugs is increasing so rapidly that the Champion Ignition Company has been forced to contract for another large four-story addition to its plant. The new building which the company erected a few months ago has already been outgrown.

Remy Makes Several Branch Changes.

**Boston Branch Now in New Location,
and Several Improvements Have
Been Made at Detroit.**

The Boston branch of the Remy Electric Company has been moved from 214 Pleasant street to a more satisfactory location at 8 Motor Mart, Park square. The Remy company also advises that L. L. Kershner has been chosen as company representative in charge of the Philadelphia service station, which goes under the name of the J. C. Duncan, Jr., Company, and was formerly managed by William Barton. At the Pittsburg service station, the name of which is the Dyke Motor Supply Company, R. C. Rhodes has been succeeded by T. W. Richman as Remy representative.

The Remy company has been developed to remarkable standards in recent months, one of the latest improvements at the Detroit plant being the installation of probably the most completely equipped laboratory ever devoted to the development of ignition, starting and lighting equipment. Scientific research is facilitated by there being a complete experimental machine shop and chemical and testing laboratories. The sales headquarters of the company are at East Grand boulevard.

\$10,000,000 FEDERAL CAPITAL.

The Federal Rubber Company of Chicopee Falls and Cudahy, Wis., controlled by the Fisk Rubber Company of Chicopee Falls, Mass., has been organized under the laws of Massachusetts with a total authorized capitalization of \$10,000,000. The capital is composed of 30,000 first preferred, 20,000 second preferred and 50,000 shares of common stock. Holders of second preferred may exchange their shares for common stock. The total amount of these two issues shall not exceed 70,000 shares.

CHANGE IN PARAMOUNT COMPANY.

C. A. Mattison, formerly sales manager of the Detroit Engineering Products Company, maker of Paramount Interruptors and other devices, is now general manager of the company. Coincident with his change of office comes the announcement that a new product is to be put on the market, a device especially designed for Ford cars and known as the Paramount snubber, which is designed to overcome the results of road shocks.

In line with its work of last year, the Long Island Railroad Company has begun a campaign against reckless driving across its road crossings. Due to its vigorous efforts during 1915 not a person was killed by its trains, though there were serious accidents and many hairbreadth escapes. The campaign will be conducted much along the lines of that of last year.

Paige-Detroit Declares Stock Dividend.

This Action Makes a Total of 180% in Less Than One Year, Not Including 5% Cash a Month.

According to an announcement from Harry M. Jewett, president of the Paige-Detroit Motor Car Company, the directors of the company at a recent meeting declared an 80% stock dividend, payable to stockholders of record May 13. They also decided to increase the capital of the company from \$1,000,000 to \$2,000,000 and to reduce the par value of each share of stock from \$100 to \$10.

The stock dividend is to be 80% of the present outstanding capital stock of \$500,000 and will represent stock of the par value of \$400,000, which it is proposed to issue from the present authorized capital that has been retained in the company's treasury. At the present market price of Paige-Detroit stock, the dividend has a market value of more than \$3,500,000.

As the company declared a 100% stock dividend last August, the present action means 180 per cent. in less than a year. In addition, as further evidence of the success of the company and its product, the directors have been regularly declaring 5% cash dividends each month.

The company's growth has been steady, though remarkable. Starting in 1909 with a capital of \$100,000, all subscribed, in the following year it was increased to \$250,000. The increase to \$1,000,000, retaining \$500,000 in the treasury, was authorized in June 1915. The business has developed from a production of a few hundred cars and a small number of dealers to the present production of approximately 18,000 cars a year and a selling organization of 1200 agents.

NEW PRESIDENT FOR NORMA.

At the annual meeting of The Norma Company of America, held recently in the New York City offices, W. M. Nones was elected president and treasurer. Prior to this Mr. Nones was secretary-treasurer, as well as general manager. In his new position he will continue to exercise the general management of the concern, which in five years has grown from a small import business to a commanding position among the American manufacturers of ball, roller, thrust and combination bearings.

GRANT TO BUILD IN CLEVELAND.

It is officially announced that the Grant Motor Car Corporation will locate its new factory in Cleveland, the plant to contain 150,000 square feet of floor space and to be of the most modern construction. This move is made necessary because the Grant company's facilities at Findlay, O., have been far outgrown though the annual production there has been 10,000 cars. In the new location the company has eight acres of ground

in the heart of Cleveland's East End manufacturing district and adjoining the New York Central railroad tracks, with ample room for future expansion. Construction is already under way, and it is announced that deliveries of Grant cars from Cleveland will begin about Aug. 1.

BROWN WITH SCRIPPS-BOOTH.

W. I. Brown, for the past two years supervisor of sales for Dodge Bros., and previous to that a Studebaker distributor at Indianapolis, has joined the Scripps-Booth Company in the capacity of assistant sales manager. Through his connection with some most comprehensive sales campaigns he is known from coast to coast by the leading dealers.

This acquisition by the Scripps-Booth Company, as well as others of a like nature in the recent past, are ascribed as indications of the endeavor of the company to build up a sales and service or-



W. I. Brown, Assistant Sales Manager, Scripps-Booth Company.

ganization that will conform to the high class of its clientele and meet the demands of a greatly enlarged market.

SAXON DECLARES \$1.50 DIVIDEND.

The Saxon Motor Car Corporation, Detroit, has declared an initial dividend of \$1.50 a share on its \$6,000,000 capital stock, payable July 1. It is understood that the dividend rate of six per cent. will be made permanent, and that the company is now earning at the rate of 24 per cent. on its stock.

President H. W. Ford said: "May shipments will exceed the record production of 3405 cars in April. I expect that we will ship about 3800 this month and about 27,000 in the fiscal year ending June 30. Earnings will undoubtedly exceed my estimate of \$1,250,000 made last December. From orders on hand I believe the Saxon company will have to produce 50,000 cars in 1917 to meet the demand.

Motor Vehicle Stock Prices Are Soaring.

Sensational and Continued Advance of Prices Are Due to Extraordinary Demand and Profits.

The remarkable demand for motor cars of all kinds and the extraordinary profits accruing to the manufacturers have sent share prices to astonishing heights on the markets, and they are now furnishing unusual sensations to brokers and speculators.

Chevrolet Motor stock is a striking example. During the past six weeks it has risen 100 points. On March 1 it sold at \$130, May 1 at \$200 and May 18 at \$233. This advance is an eloquent commentary upon the volume of business being done among the makers of low priced cars, as well as upon the acumen of the head of the Chevrolet Motor Company, W. C. Durant.

Chevrolet today is earning more than \$725,000 a month, and these earnings will increase in greater ratio than production increase owing to resulting reduction in the cost of manufacture per car as the volume grows. Now turning out 360 Chevrolets a day, it is expected that in August the output will be at the rate of 460 daily. On the 1917 planned production of 150,000 cars net profits should total approximately \$12,000,000, or \$60 a share.

Chandler Motor stock has been another active participant in the recent advances of prices, it having reached a new high level of 98 on May 18. The directors placed the stock on a six per cent. basis in February by declaring a quarterly 1½ per cent. rate. Earnings thus far this year have been running at the rate of approximately 30 per cent. per annum on the \$7,000,000 stock outstanding.

General Motors, which has occupied the stellar position in Wall street for some time, is quoted at a level 3½ times its prices of a year ago. Maxwell, a company that was reported to be in poor financial condition two years ago, had its common shares doubled in value in a year. Studebaker has been returned to a level 150 per cent. higher than at this time last year. Willys-Overland is also selling at 2½ times its price of 12 months ago.

Since the receipt of the German reply, which cleared up the submarine issue, practically all stocks have been influenced for the better. This is shown in the tabulation below, which gives the prices as of May 18, May 5 and 13 months ago:

	May 18	May 5	April 19	1915.
Chandler	97½	89	90½	
Chevrolet	233	196	178	
General Motors *465		405	405	
Maxwell	89½	73	70½	
Studebaker	141½	121	131	
White	52	48	49½	
Willys-Overland 262½		227	220	

*May 15.

WORLD'S RECORD AT SHEEPSHEAD.

Aiken Establishes New Mark for 20 Miles—Rickenbacher and Mulford Also Win—Limberg Killed.

THAT the crushing out of the lives of Carl Limberg and Roxey Pallotti, mechanic, was responsible in large measure for the comparatively slow time made in the Metropolitan Trophy race at Sheepshead Bay on May 13 is shown by a study of the time cards of the two events preceding that race. The Coney Island Cup and the Queens Cup contests were run off preliminary to the Metropolitan Trophy and in the first Johnny Aiken, the winner, broke the world's speedway record for 20 miles. In the Queens Cup race Mulford lacked only a few seconds of equaling the record for 50 miles. The first 30 miles of the Metropolitan Trophy were covered in record time, as is shown by the fact that Limberg at the time he met his death in this lap was speeding at about 104 miles an hour.

Thirteen cars were lined up for the first event of the afternoon, the Coney Island Cup race. They were sent away in a "rolling start" and almost immediately the race developed into a struggle between Aiken and Mulford, both driving Peugeots. The pace was terrific, and Rickenbacher, in a Maxwell, fought to gain the lead, but was outdistanced. Next Christiaens, in a Sunbeam, closed in upon the leaders and struggled with them for several laps. Before the race was half over it was apparent that the honors rested between Aiken and Mulford, both of whom were putting forth their best efforts and were racing almost wheel to wheel.

Two laps from the end of the race a flat tire and engine trouble sent Mulford

STARTERS IN THE METROPOLITAN TROPHY RACE.

Driver	Car
Carl Limberg	Delage
Jules Devigne.....	Delage
Ralph Mulford	Peugeot
Eddie Rickenbacher.....	Maxwell
Dario Resta.....	Peugeot
Aldo Franchi.....	Pusun
C. J. Devlin.....	Deussenberg
Bert Watson.....	J. J. Special
George Adams.....	Adams Special
Ira Vail.....	Hudson

RESULTS OF THE RACES.

Queens Cup—50 Miles.

Pos.	Driver	Car	Time	Prize
1—	Mulford,	Peugeot.....	28:45	\$1000
2—	Devlin,	Deussenberg.....	30:15	600
3—	Franchi,	Pusun.....	30:16	400

Coney Island Cup—20 Miles.

Pos.	Driver	Car	Time	Prize
1—	Aiken,	Peugeot.....	11:15	\$600
2—	Christiaens,	Sunbeam.....	11:26	350
3—	Limberg,	Delage.....	11:27	250
4—	Rickenbacher,	Maxwell.....	*	200
5—	Henderson,	Maxwell....	*	100

Metropolitan Trophy—150 Miles

Pos.	Driver	Car	Time	Prize
1—	Rickenbacher,	Maxwell	1:33:31	\$6000
2—	Devigne,	Delage.....	1:35:11	3500
3—	Vail,	Hudson.....	1:38:44	2000
4—	Adams,	Adams Special ..	*	1500
5—	Watson,	J. J. Special..	*	1000

*Time not recorded.

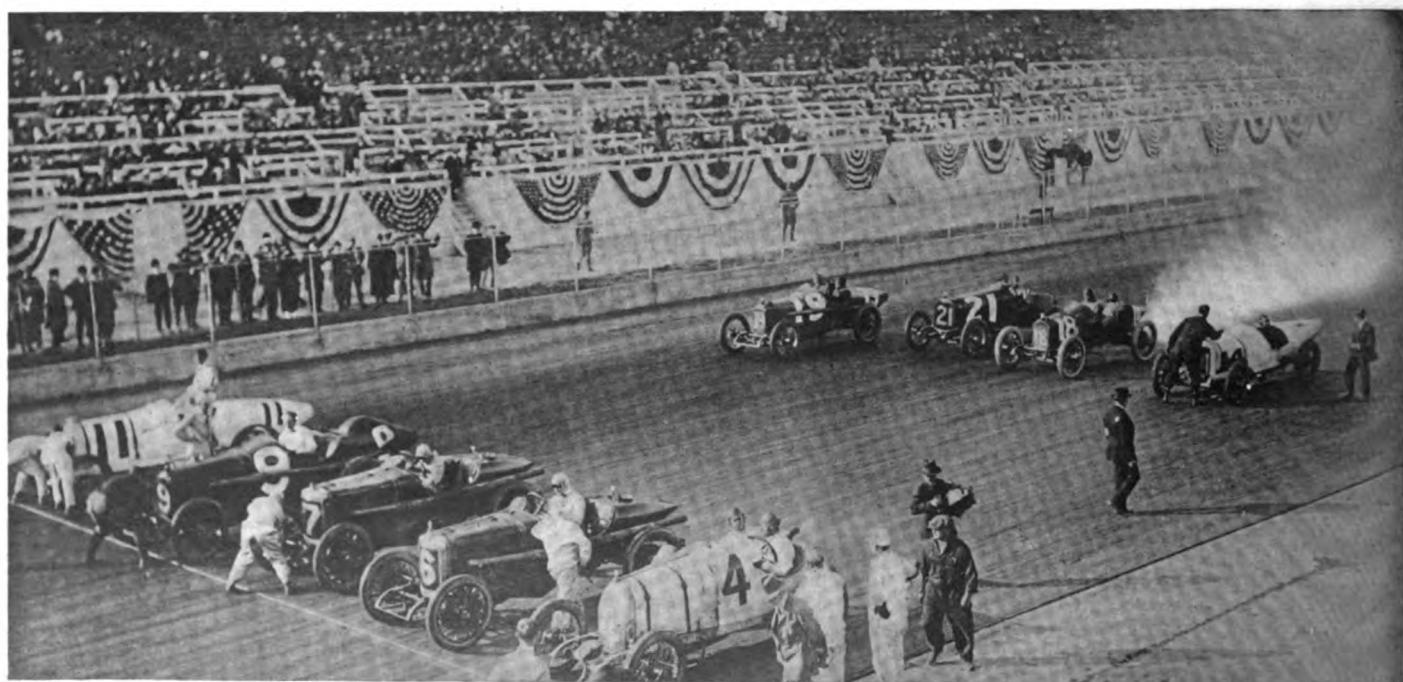
to the pits. The mishap left Aiken with a clear field, he flashing across the finish line with the honor of establishing a world's record for the distance and course. His time was announced officially as 11:15 for the 20 miles. He was 11 seconds ahead of Christiaens, who came in second, and 12 seconds ahead of Limberg, who took third place. Rickenbacher finished fourth and Henderson fifth.

In the Queens Cup, the distance of which was 50 miles, the two Peugeots, handled by Mulford and Aiken, were again struggling for supremacy from the very start. But in this contest Rickenbacher and Limberg held their cars close to the leaders, the latter taking the lead in the backstretch of the second lap and holding it by daring driving.

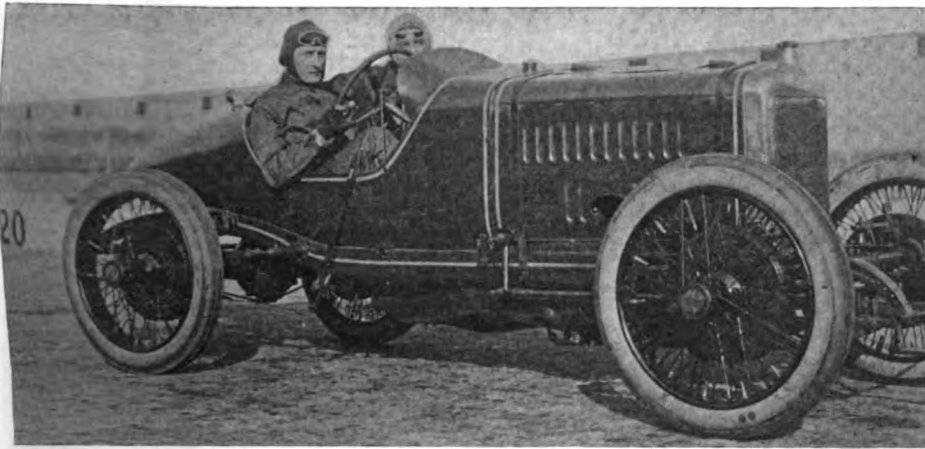
Early in the race Rickenbacher pulled up at the pits with a flat tire, and though the change was made in 16 seconds, the leaders had pulled so far away from him that he was unable to finish in the money. At the 10th and 20th mile marks Limberg was leading, with Aiken one second behind, and Mulford coming third, three seconds behind the leader. Limberg was handling his big Delage in a masterly manner and looked like a winner, but in the 25th mile a tire went flat. He experienced trouble with the gears of his car and when finally on the track was trailing along with the second division.

At this stage the race had again dwindled into a contest between Mulford and Aiken. They drove mile after mile within 20 feet of each other, until in the 44th mile Aiken was forced out of the race because of burnt out bearings. At the same time Devigne, who had been third, drove his Delage to the pits with a flat tire and engine trouble.

Mulford with all serious opposition gone, finished in front in 28 minutes and 45 seconds, an average rate of about 100



Start of the 150-Mile Metropolitan Trophy—In Front Row, Right to Left, Watson (J. J. Special), Limberg (Delage), Devigne (Delage), Mulford (Peugeot), Rickenbacher (Maxwell)—Second Row, Devlin (Deussenberg), Adams (Adams Special), Vail (Hudson), Resta (Peugeot).



Carl Limberg and Roney Pallotti in the Delage Car in Which They Lost Their Lives.

miles an hour. Devlin in a Deussenberg came in second in 30 minutes and 15 seconds, while Franchi in a Pusun finished in third position one second later.

The two preliminary events had served to whet the appetite of the crowd, and as 10 of the cars lined up before the

into a straight course again along the rim of the track. Again it turned and this time headed almost directly for the rail, striking it with terrific impact and hurling Limberg and his mechanic, Pallotti, over the rail and to the ground 30 feet below. The car, bounding 20 feet

Only by heading his car directly to the concrete level at the bottom of the track could Devigne avoid collision. At the rate he was driving, the car spun around three times before the driver regained control and continued the race, eventually coming in second.

The seven remaining drivers continued the gruelling pace, though they gradually and probably unconsciously slackened speed. The flaming car proved a depressing factor, and though the drivers did not know that Limberg and Pallotti had been killed, they were aware that a serious accident had occurred.

At 50 miles the order of going was Rickenbacher, Resta and Devigne. At 72 miles Resta went out with tire trouble, and Rickenbacher took the lead, which he held until he had to stop to change spark plugs and take on oil in the 90-mile lap. At 100 miles Resta had the lead, with Rickenbacher second and Devigne third. The driver of the Maxwell was creeping up when at 114 miles Resta's Peugeot developed engine trouble. Five minutes later trouble developed in

TECHNICAL DETAILS AND DESCRIPTION OF EQUIPMENT OF THE COMPETING CARS.

Car.	Driver.	Cyl.	Bore.	Stroke.	Displ.	Igni.	Plugs.	Carb.	Oil.	Wheel-base.	Wheels.	Tires Make.	Size.	Shock Absorb.
Adams Special.	Adams.....	4	3 3/4	6 3/4	298	Bosch	8	Master	Mobilol	100	Rudge	Thermoid	34x4 1/2	Hartford
Peugeot	Aiken.....	4	3.6	6.6	274	Bosch	4	Zenith	Oilzum	106	Rudge	Silvertown	34x4 1/2	Hartford
Erwin 40.....	Bergdoll.....	4	4	6	298	Bosch	8	Master	Mobilol	108	Rudge	Silvertown	32x4 1/2	Hartford
Crawford Spec.	Chandler.....	4	3 3/4	6 3/4	298.8	Bosch	8	Zenith	Oilzum	106	Rudge	Silvertown	33x4 1/2	Hartford
Sunbeam	Christiaens...	6	3 1/4	6.14	294	Bosch	6	Claudel	Oilzum	113	Rudge	Silvertown	35x5	Hartford
Delage	Devigne.....	4	3.7	6.3	274	Mea	4	Claudel	Oilzum	106	Rudge	Silvertown	34x4 1/2	Hartford
Deussenberg ...	Devlin.....	4	3 3/4	6 3/4	298	Bosch	8	Miller	Oilzum	106	Rudge	Silvertown	32x4 1/2	Hartford
Pusun	Franchi.....	4	3.7	6.3	274	Bosch	4	Zenith	Oilzum	106	Rudge	Silvertown	34x4 1/2	Hartford
Maxwell	Henderson....	4	3 3/4	6 3/4	298	Bosch	4	Miller	Oilzum	106	Houk	Silvertown	34x4 1/2	Hartford
Delage	Lecain.....	4	3.7	6.3	274	Bosch	4	Zenith	Oilzum	106	Rudge	Silvertown	34x4 1/2	Hartford
Crawford Spec.	Lewis.....	4	3 3/4	6 3/4	298	Bosch	8	Miller	Oilzum	106	Rudge	Silvertown	33x4 1/2	Hartford
Delage	Limberg.....	4	3.7	6.3	274	Mea	4	Claudel	Oilzum	106	Rudge	Silvertown	34x4 1/2	Hartford
Peugeot	Mulford.....	4	3.6	6.6	274	Bosch	4	Zenith	Oilzum	106	Rudge	Silvertown	34x4 1/2	Hartford
Peugeot	Resta.....	4	3.6	6.6	274	Bosch	4	Zenith	Oilzum	106	Rudge	Silvertown	34x4 1/2	Hartford
Maxwell	Rickenbacher	4	3 3/4	6 3/4	298	Bosch	4	Miller	Oilzum	106	Houk	Silvertown	34x4 1/2	Hartford
Erwin 40.....	Stecher.....	4	4	6	299	Bosch	8	Master	Mobilol	108	Rudge	Silvertown	32x4 1/2	Hartford
Hudson	Vail.....	6	3 1/2	5	288	Delco	6	Hudson	Veedol	104 1/2	Rudge	Silvertown	34x4 1/2	Hartford
J. J. Special..	Watson.....	4	4	6	299	Bosch	8	H. & N.	Mobilol	101	Rudge	Silvertown	33x4 1/2	Hartford

starter for the Metropolitan Trophy, they were greeted with prolonged cheers. Conspicuous among them was Resta in his blue Peugeot, his first appearance of the day. Almost at the start Limberg shot to the front and by his daring driving held the lead until 30 miles had been reeled off. Up to the 18th mile Mulford held second position, but in that lap went out of the race with a broken piston. Limberg seemed to develop greater speed and the pace was so swift that spectators began to look forward to another world's record.

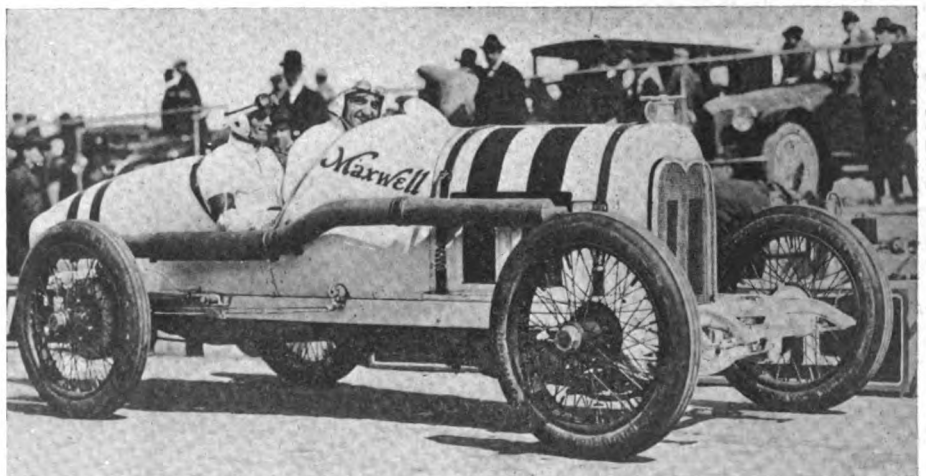
At 20 miles Limberg was followed closely by Resta, while Devigne was third, less than two seconds behind the leader. At 30 miles Limberg went out with tire trouble and Resta took up the pace. Again Limberg took up the struggle, driving as he had never driven before, taking the turns in great swoops from the top of the track in the effort to cut down the lead. He had regained second place and while speeding after Resta took the north turn of the course high up on the bank at a speed that has been estimated at about 104 miles an hour. Suddenly a tire burst and the yellow Delage swerved. Limberg brought it back

into the air, slid down to the inner level and was immediately enveloped in flames. Limberg had been killed instantly and the mechanic died while being taken to the hospital.

Fifty feet behind the ill-fated Delage was Jules Devigne, Limberg's team mate.

the valves and Resta was out of the race.

Devigne spurred at 120 miles and for a short distance led Rickenbacher by a wheel, but had to relinquish it when his motor caught fire. After that Rickenbacher was never headed and finished the 150 miles in one hour and 33 min-



Eddie Rickenbacher and His Mechanician, Latta, in the Maxwell Car in Which They Won the Metropolitan Trophy.

utes, an average of 96.23 miles an hour. Devigne, despite the accident to his team mate and his own troubles on the track, finished second in one hour and 35 minutes, while, much to the surprise of the spectators, the little Hudson, driven by Ira Vail, came in third in one hour and 38 minutes. This car, which was the same stock model in which Mulford had established a 24-hour record a few days before, had run the race without a stop.

LIGHT SPEEDWAY FOR EVENTS.

The entire two-mile speedway at Sheepshead Bay, including the 160-acre interior field, is to be brightly lighted for athletic and sporting events that will be held at night during the coming summer. One of these will be a 24-hour automobile race.

The initial installation will be 370 General Electric flood light projectors, each with a 500-watt gas filled type C Mazda lamp. Especially bright lights will be provided immediately in front of the grandstand and at the pits, while the whole track will be illuminated to an intensity from 50 to 100 times greater than bright moonlight.

ACROSS COUNTRY IN AN ALLEN.

An Allen car was recently subjected to an unusual test of endurance in a transcontinental trip in the hands of its owner, Earl Anderson, brother of Gil Anderson, and himself a racing driver of considerable note. Anderson followed the southern route from New York City to San Diego and then rode northward to San Francisco. While crossing Death Valley he purposely subjected the car to severe tests, and was agreeably surprised that this medium priced car proved eminently satisfactory. "If there was ever a test of a car's sturdiness," said Mr. Anderson, "it was that trip. I never had a moment's trouble of any kind. In traversing Death Valley and in making the long climbs over the grades, the water never boiled in the radiator."

New TIB Touring Route Books.

One Large Book Covers Entire Country, While Five Smaller Ones Are Devoted to Sections.

The Touring Information Bureau, Shukert building, Kansas City, Mo., has issued its route books for the 1916 season in a revised and greatly enlarged form. The great middle western states have been mapped in the greatest detail, while connecting routes for tourists to both the Atlantic and Pacific coasts are supplied.



The large touring book covering the country includes detailed road directions, and garage and hotel information for 100,000 miles of roads. This is arranged according to states and the information is broken up into five state sections, which are also printed as separate books selling for a low price.

The sectional books are known as the Iowa-Nebraska state edition, Kansas-Missouri state edition, Indiana-Illinois state edition, Minnesota-Wisconsin state edition, and the Colorado state edition. These books contain detail maps and running directions for all the main routes between important points and enable the tourist to reach practically

every town of consequence in the various states.

Most of the districts have been covered by the pathfinding cars of the bureau and an investigation made of the service offered by the hotels and garages. Some of these have been marked with the TIB sign, which indicates that they have been approved by the investigators of the bureau.

Each purchaser of one of the route books receives with it a card which, when sent to the main office of the Touring Information Bureau, secures for him a card showing his membership in the bureau and entitling him to special consideration in the matter of aid and advice on routes and similar matters when it is displayed at any of the official stations of the bureau. A special service is also maintained at the headquarters to answer questions and supply route information that may be specially requested and which is not covered by the very complete route books.

The national guide book, which comprehends all the sectional books, outlines several transcontinental routes, including the Lincoln and the National Old Trails highways. There is also a route from Canada to the Gulf.

PATHFINDER ON OREGON TRAIL.

Ezra Meeker, a pioneer of the old school, who first followed the Oregon Trail from Indianapolis to Oregon in 1852 and made a transcontinental trip, driving a yoke of oxen, in the years 1910, 1911 and 1912, is now en route from Washington, D. C., to Oregon in a specially equipped Pathfinder Twin-Six car. Mr. Meeker is now 85 years of age, and his purpose is to continue the marking of the now nearly lost Oregon Trail with stone monuments and to preach the gospel of patriotism to whom ever he meets on the journey. During his second trip, which endured for 22 months, he erected a large number of monuments in memory of the heroic pioneers who met the hardships of the trail more than a half century ago.

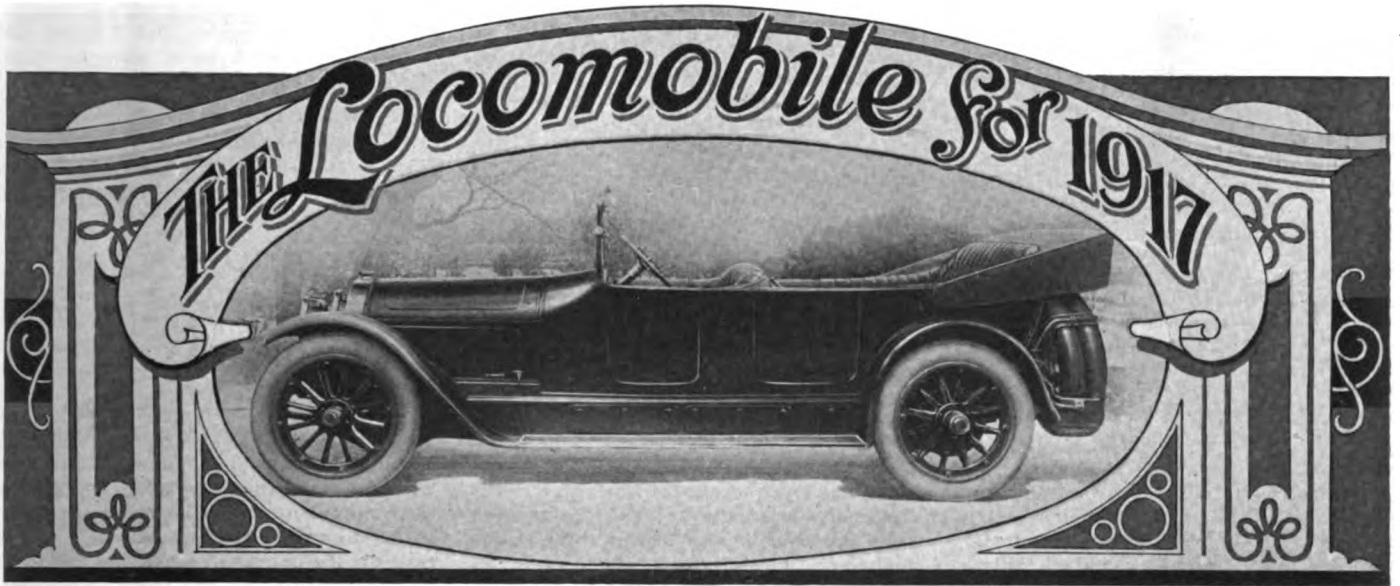
The car is a special "job." The regulation body has been removed and in its place has been installed a prairie schooner body and top. In explaining why he chose this type of what he called his "schoonermobile," Mr. Meeker said: "I intend to live in the car until the trip is completed, and by careful planning and minimizing useless space, it is surprising how much a prairie schooner body will carry and still be homelike indeed."

MILITARY TRUCK SPECIFICATIONS.

United States army officers and automobile engineers gathered recently in the rooms of the S. A. E. to confer on the annual revision of specifications for one and ½-ton trucks. The purpose of the gathering was to informally discuss standards as to quality of materials, interchangeability of parts, load capacity, road speed, location of control, ground clearance, engine capacity, suspension, electrical equipment and many other elements.



The Pathfinder Twin Six in Which Ezra Meeker is Following the Old Oregon Trail from the National Capital to the Pacific.



LOWER in height and longer in appearance, although slightly shorter in actual measurements, the two new Locomobile chassis for the 1916-17 season present the same basic features as in former years. While the motor dimensions are unchanged, a new carburetor, lighter reciprocating parts finished more accurately, a superior balance of the motor and a slight change in the springing have combined to produce a car which has much quicker acceleration, snappier action at all speeds, more power and speed, very much improved riding qualities and most unusual fuel economy.

Longer front springs have had the effect of shortening the wheelbase of each model one inch; the new front springs are 40 inches, two inches longer than last year. The frame length is unchanged, so the front axle has been moved back one inch to occupy the same relative position on the spring as before. With this exception the general specifications are the same as last year, but there are very many small detail improvements and refinements.

The two chassis follow along standard lines; that is, each has a vertical six-cylinder motor located at the front end

of the frame, cooled by a honeycomb radiator, driving through a dry disc clutch to a standard type of four-speed transmission located in the middle of the chassis, thence by shaft to the full floating rear axle, and thus to the rear wheels.

Two Locomobile Chassis.

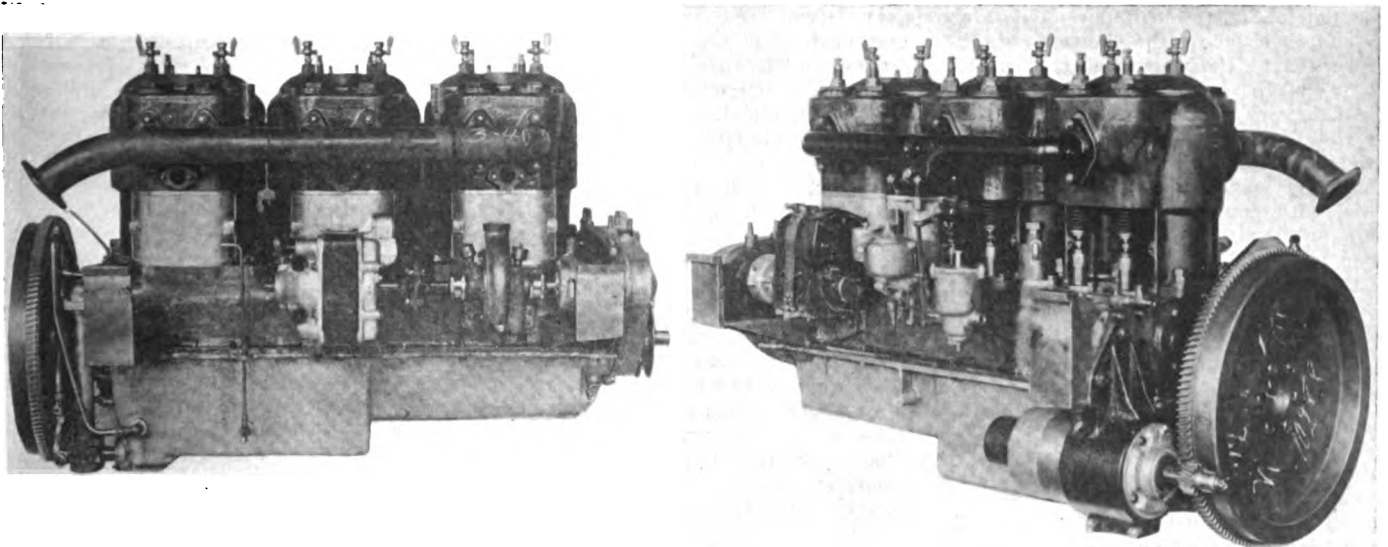
These two chassis, now in their sixth and seventh years respectively, include same high quality of materials, workmanship and design as in previous years. They are known respectively as the "M-7" and "R-7" and are produced by the Locomobile Company of America, Bridgeport, Conn. The former has a motor of 4½-inch bore by 5½-inch stroke, developing a maximum of over 82 horsepower and a wheelbase of 142 inches. The "R-7" is a motor of 4¼-inch bore and five-inch stroke, developing a maximum horsepower of more than 65, and a wheelbase of 139 inches. Aside from these differences and a few other minor ones, the two chassis are identical.

The Locomobile type of motor has six vertical cylinders. The six-cylinder motor is used because it gives the most even torque and the best balance. In addition, it is lacking in complexity and

has a small number of different parts. It represents the soundest engineering practise, in that it produces maximum results with the simplest construction. The cylinders are of the T head type, which is the most expensive to build, but the most economical of length, and is reliable, symmetrical and accessible.

Locomobile cylinders are cast in pairs of the finest gray iron, fully aged and bored and ground with extreme exactness. Pistons have two compression rings at the top, and at the bottom an oil ring of the plain diagonally cut type. All exterior surfaces of pistons and rings are ground. The pistons are of the so-called trunk type and are ribbed inside for strength. By comparison with last year, several ribs have been omitted and the whole piston lightened in weight. The pistons also are finished more carefully and are brought to an exact weight, with a tolerance of but 1/16 of an ounce.

The connecting rods are alloy steel Locomobile forgings of the H section, and are file finished all over, being brought to an exact weight and paired by exact centre of gravity location. The wrist pins, which are case hardened steel, are fixed in the pistons and turn in



The Six-Cylinder Locomobile Motor, Which for 1917 Has Several Refinements That Make This Engine One of the Most Dependable Now Used in Automobiles.

the bronze bushings in the upper end of the connecting rods. The lower ends of the rods are split and each carries a two-part bronze bushing, heavily faced with babbitt. The final operation on the bushings, before hand scraping, is to peen down the wearing surface in a broaching machine, thus making the metal harder and more dense. The connecting rod caps are each held on by two large diameter chrome nickel steel bolts.

A notable feature of the motor is the bronze engine base, the integral arms of which extend to the frame, where they are securely bolted. This forms a structure of great strength and safety, in fact it is said that the Locomobile company has never replaced an engine base on account of breakage in service. The crankshaft is an enormously strong forging of heat treated chrome nickel steel. It is ground all over, is very accurately balanced in a specially accurate balancing machine and rotates in seven large bearings of special bronze with heavy babbitt facings.

Cooling is accomplished by means of

been improved and silenced by the use of fibre inserts in the push rods and the complete enclosure of the valves in neat two-part aluminum housings. The valve key is a new design in two parts with a conical seat. This gives a doubled supporting surface and thus longer life and quieter action. It is easier to place and replace.

Lubrication is accomplished by a low-pressure circulating system. The oil is pumped in a constant stream to the bearings and points of friction by means of a gear pump, with a removable strainer, and located outside of the crank case, so as to be readily removable. A pipe in the lower half of the crank case supplies the troughs into which the connecting rods dip, and a similar pipe in the upper half has leads to all of the main bearings and an overflow to the timing gear case at the front. These troughs are higher at the rear, thus furnishing more lubricant on the up grades and less on the down.

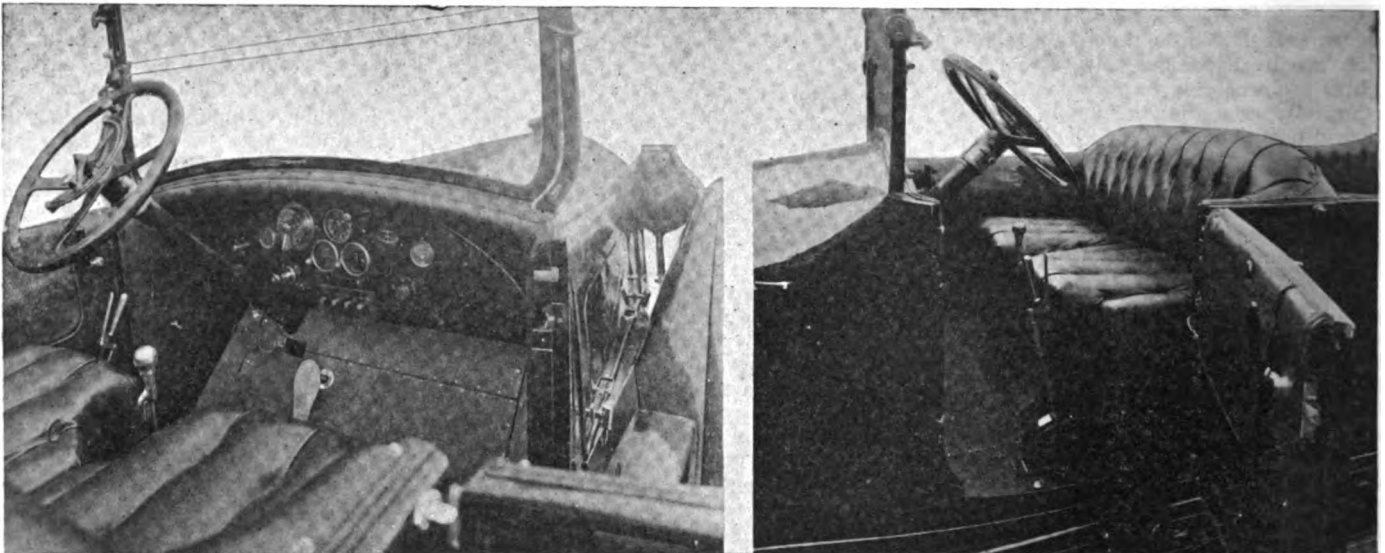
Locomobile ignition is of the high-tension, dual type, with a storage battery,

and unmeshing easier and quieter, the shape of the teeth being such as to assist both operations.

Four Brush Generator.

The generator is a four-brush constant current, compound wound, Locomobile-Westinghouse type, with a high normal capacity. The appearance has been improved.

One of the most important features is the Locomobile-Ball carburetor, designed and constructed completely in the Locomobile plant. It is of the two-stage type with a low speed jet which handles the car ordinarily. When the demand is excessive, as when high speeds are desired or great pulling power, the high speed or second stage may be cut in at will and furnishes the excess. This is the equivalent of a second carburetor, added to the first. As soon as the extraordinary demand ceases, this jet may be cut out and only the more economical low speed jet operates. It affords economy, flexibility and rapidity of operation not produced by any other vaporizer. In



Two Views of the Front Compartment, That at the Left Showing the Arrangement and Location of the Dash and Control Units—At the Right Is Another View of the Compartment, Showing the Gear Shifting Lever in the Centre and the Brake Lever Nearest the Left Hand Door.

liberal water jackets surrounding the upper portion of the cylinders and down to one inch below the bottom of the piston travel, the water being circulated by a large centrifugal bronze pump through very simple straight pipes, and in the direction in which the water would flow naturally. The radiator is an unusually large unit of the honeycomb type, with copper tubes. As compared with previous years, its appearance has been improved by increasing the height of the sides and flattening the top curve. This has increased the water capacity of the system slightly.

Silent Timing Gears.

The timing gears are placed at the forward end of the engine base, in an oil-tight aluminum housing. Unusual silence of operation has been obtained by the use of spiral gear teeth and specially selected metals, also by running the gears in a bath of oil which is constantly renewed by the oil pump.

The valve operating mechanism has

and a high-tension Eisemann magneto, gear driven from the motor. The battery system uses the distributor on the magneto. The cables are carried across the tops of the cylinders in a neat mahogany conduit, the use of wood preventing the self-induction losses of a metal tube.

The electric starting motor is the Locomobile-Westinghouse, a powerful and very silent unit, designed especially for use on Locomobile cars. It is operated by a button, "touch the button to start" being a most attractive and exclusive Locomobile feature. Shifting of the starting gear is accomplished electrically by a solenoid on the rear end of the armature. The housing is simpler, more complete and more pleasing in appearance. The motor is located on the left side, below the crank case arm, so that it works against the under side of the fly-wheel starting ring. Both gear and ring have spiral teeth inclined at an angle of 13 degrees; this makes both meshing

addition, it incorporates a special, simple accelerating device, designed to give unusually rapid pickup. Despite all these remarkable qualities, the carburetor is very simple and has only one adjustment. It is located on the left side of the motor, opposite the two middle cylinders, the hot air supply from the exhaust pipe running between the first two pairs of cylinders to it.

Power is transmitted through the Locomobile disc clutch. This is of the dry type, with fabric discs floating between driving and driven members, and gives unusual smoothness in clutching and de-clutching. It is entirely enclosed and requires no lubrication or other attention.

The gear box is notable for having a manganese bronze case of great strength and provides four forward speeds and reverse. This type was developed by the Locomobile company 10 years ago, and has been continued with only minor changes since. The gears, shafts and shifting members are of the finest chrome nickel steel, carefully heat treat-

ed and run on ball bearings of the highest quality. The shafts are equipped with stuffing boxes which are proof against leakage of grease. This member is located amidships and may be removed entirely without disturbing the clutch in front of it or the driving shaft back of it.

Similarly, the clutch or any other unit, the magneto, pump or any other accessory may be removed individually, a feature often overlooked; all units are made accessible in this way.

Power is transmitted to the rear axle through a chrome nickel steel propeller shaft which is practically horizontal under load. The shaft has enclosed universal joints at the ends, the forward one being of the ball bearing type.

Details of Rear Axle.

The full floating rear axle is of Locomobile design and construction. The cast steel central housing contains the differential and driving gears, and has nickel steel tubes at either side forced

Then the shafts are heated to 1400 degrees, quenched in oil, and drawn to 750 degrees. Then they are sand blasted to clean them and are inspected and tested for hardness. The Brinnell test calls for a hardness between 286 and 301, and in this and the Scleroscope test two readings are taken at widely different points. The average of these is used, providing both are above the standard. If either is below it, the shaft is rejected. The shaft is given a final straightening and then is delivered to the assembling room, where it is inspected before use, making a total of nine inspections.

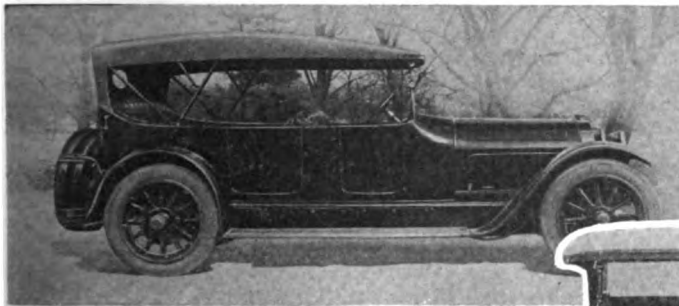
The distance rods have large lubricated bearings on the axle tubes, and their front ends are universally mounted, properly handling all stresses. The torque rod is a pressed steel member of channel section driven into and firmly bolted to the cast steel differential housing and is equipped with a pivot and spring suspended forward end, which is fastened to a frame cross member. This

centre portion. The clearance is unchanged.

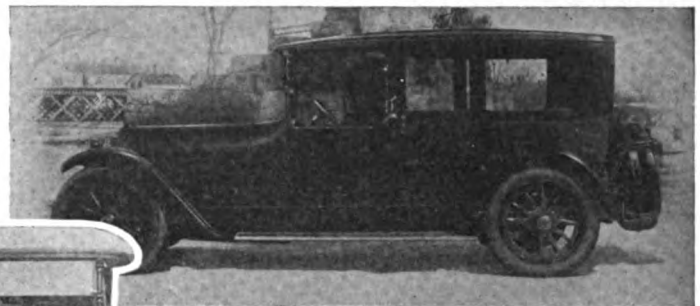
Rear Spring Assembly.

Rear springs are three-quarter ellipsics, $2\frac{1}{2}$ inches wide, the lower member shackled at both ends, and by comparison with last year, very much flatter. The springs are of special chrome nickel tungsten steel and the bolts are heat treated chrome nickel with grease cups formed integral to lubricate the spring eyes and bushings.

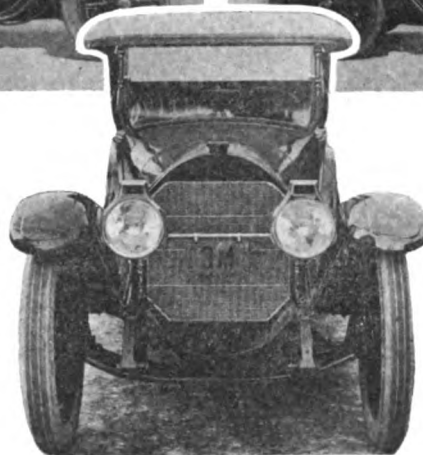
The foot brake is external contracting and is operated by the right hand pedal. The hand brake is internal expanding and is operated by a latched lever placed at the driver's left. The brake shoes are steel, lined with a heat proof fabric, and are mounted so that readjustment is accomplished conveniently, special efforts having been made to increase their accessibility. The brakes operate against different concentric drums, which have a larger air space between, effectively preventing overheating. In an emer-



The Locomobile 48 Seven-Passenger Touring Car.



The Locomobile 48 Limousine Body for 1917.



Front View of the Locomobile 38 Six-Passenger Car.

in by hydraulic pressure and riveted. The gears are spiral bevels, made from forged chrome nickel steel especially cut. The differential is provided with splined openings, into which fit the inner splined ends of the live axles. These are very strong, being heat treated chrome nickel steel forgings of large diameter. The outer ends are in the form of dogs, which are cut in a much enlarged integral flange. These are engaged with the drive corresponding dogs on the rear wheel hubs. The hub caps are dust covers and do not form any part of the shaft drive mechanism. By removing them it is possible to remove the live axles for inspection.

The method of handling the rear axle is typical of the extreme care used on Locomobile parts. The shafts are received in the form of shaped forgings which have been rough turned. After the rough forging they are heated to 1600 degrees, quenched in oil and drawn so as to fibre the steel and render it easy to machine. As received the forgings are inspected, then turned, the flange recessed and the shafts recentred. This work is inspected and then they are drilled and inspected again. After straightening, the end slots are milled, and the shafts must pass inspection again. Then the oil grooves are milled and the shafts inspected. Next they are drilled and tapped, recentred, rough ground and finish ground and inspected. The driving notches are milled and file-finished, then the shafts are inspected.

absorbs all the torque reactions from the driving gears. The advantage of this construction is that the rear springs are not part of the driving system, but are shackled at both ends and, being free to act, produce unusually easy riding. When springs must absorb driving and torsional reactions, the flexibility is limited and body and passengers ride hard.

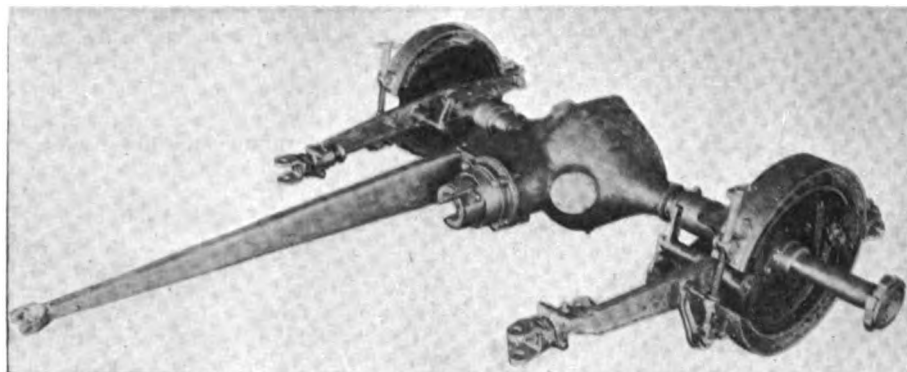
Front springs are semi-elliptic, two inches wide, shackled at the rear and two inches longer than last year and of much flatter shape. In addition they are supported two inches lower on the front axle, which has been redesigned for this purpose. The front axle is of the Elliott type, which gives two bearings for the knuckle pin in the axle ends, where they can be made of a liberal size. It has a neat, continuous downward curve from the ends to the centre portion, which is more pleasing in appearance than the use of an abrupt downward curve in the

gency either set will stop the car.

Front and rear wheels of second growth hickory have 12 spokes. The front wheels are equipped with the highest grade roller bearings, which take up both end thrust and radial loads. The rear wheels have inner and outer ball bearings of the finest quality.

The chassis frame presents an unusual construction. It is pressed from a special chrome nickel alloy steel, heat treated, hot riveted, with all holes drilled and reamed. It is of great depth, six inches in the middle of the side member, while the unusual kickup at the rear lowers the body and the centre of gravity, increasing the safety. The body is supported on the two upper leaves of the rear springs prolonged for this purpose, and upon three additional special brackets on each side of the car, a total of 10 bolts being used. Throughout the chassis the design provides for safety and long life, these qualities being secured regardless of expense in materials or workmanship.

The body construction is the same as in previous years, but the body lines show many improvements. The bodies have been lowered about $2\frac{1}{2}$ inches and the running boards about three inches, making a very convenient step height. The top of the cowl has been lowered an additional inch, which lowers the rear end of the bonnet. The new auxiliary seats, of a very resilient, comfortable type, fold into the back of the front seat. This alters the compartments there.



The Full Floating Real Axle and Torque Rod of the Locomobile the Axle Being Inspected Nine Times During Manufacture and Put Through Unusually Careful Processes.

Three of these compartments are provided, which with those in the tonneau, under front and rear seats and along the running board, give unusual storage space.

The tonneau light is more simple and pleasing, with a flush position and convenient switch. A removable stanchion is provided over the rear doors for the curtains so these will open with the doors. The step light has been improved as to lens, rigidity of support and arrangement. The top is lighter in weight and more workable, the materials being more harmonious. The splash apron is of the vertical type and fills in the entire space between radiator and axle at the rear, and between frame and springs at the sides. The central hinge of the windshield has been omitted, making a stiffer, stronger, more simple shape. The forged support is fastened to the main frame. The division of the glass is one inch lower, and interferes less with the driver's vision. The pedal pads are of rubber, fit the foot better and also prevent slipping. They are renewable. The accelerator also has a new shape.

The prices for standard models are: M-7, six and seven-passenger touring, \$5400; limousine, \$6500; landaulet, \$6600; Berline, \$6800. R-7, six and seven-passenger touring, \$4600; the new special four-passenger touring, of which a very limited quantity will be built, \$4750; limousine, \$5600; landaulet, \$5700, and Berline, \$5900.

EXTREMELY LOW REPAIR COSTS.

More than 125,000 miles of service, with a total of repairs and replacements costing but \$33.84, is the remarkable record of a 1909 KisselKar which D. C. Newman Collins of New York City recently submitted to the Kissel Motor Car Company. When Mr. Collins turned in the old car for a newer model he submitted the following detailed report of expenditures made on it since its purchase in September, 1909:

1910	Valve cap, priming cock, front spring leaf, valve cap gaskets and one piston ring	\$4.50
1911	Steering gear shaft and keys	1.75
1912	One torsion bar	3.50
1913	One bronze bushing for pocket gear, one clutch, ex-	

ternal brake fibre crankshaft gear and push rod guide	16.89
1914 Crankshaft gear and hub cap	7.10

Total.....\$33.84

Mr. Collins also said that the car has averaged from 16 to 20 miles to a gallon of gasoline and when he turned it into the company was running as smoothly as many new cars.

DETAILS OF THE NEW COLUMBIA SIX.

Has Distinctive Appearance and Sells for About \$900.

The recently organized Columbia Motors Company, Detroit, Mich., which is headed by such men as J. G. Bayerline, former president of the King Motor Car Company, A. T. O'Connor, W. L. Daly and W. E. Metzger, has made its first public announcement of the constructional details of the new Columbia Six.

Throughout the chassis the units are standard product by well known parts makers, who have demonstrated their ability to make successful and high-grade components. The six-cylinder motor is the latest development of the high efficiency type, and is understood to be unusually powerful. The bore is three inches and stroke 4 $\frac{1}{4}$. The power plant is in unit and includes dry plate multiple disc clutch and a standard two-unit lighting and starting system.

It is further indicated that the car will

CHALMERS ADDS TO REPUTATION.

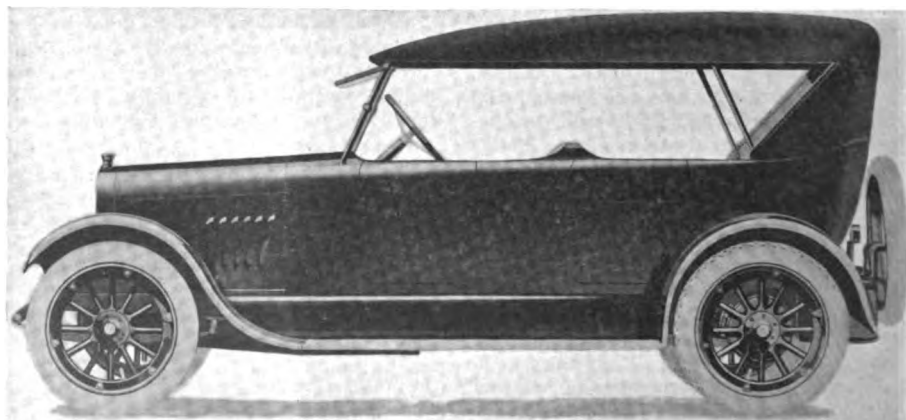
By ascending Ensign Peak in Utah and Mt. Diablo, near Oakland, Cal., the Chalmers Six-30 has added fresh laurels to its mountain climbing reputation. Ensign Peak had never been traversed by a motor car before. It is a constant series of steep grades, the final 30 feet meaning an ascent of 45 per cent. grade. The Chalmers took this in a series of short "bucks," which was made possible by the power of the 3400 revolutions per minute motor used in the car. Heavy ropes around the tires and an additional rope to the front axle was all that prevented the car from turning a somersault.

In climbing Mt. Diablo the driver removed the fan from the car, so that the trip would be an effective test of the car's cooling qualities. From Oakland the run of 102 miles to the summit of Diablo was made on high gear. The mountain has a rise of 3000 feet above sea level and has the reputation of causing the water to boil in the radiators of all cars that have attempted the trip. When the ton was reached the driver could place his hand on the radiator without discomfort. About a gallon of water was consumed on the round trip.

have Timken axles; cantilever rear springs with semi-elliptics in front; three-quarter floating rear axle; chrome nickel steel frame of extra wide sections; full crowned fenders; Stewart vacuum feed; 32 by 3 $\frac{1}{2}$ tires, non skids at the rear; and wheelbase of 115 inches.

The body is an exceptionally striking and roomy construction and has capacity for five passengers. It is by reason of excellence of finish and trim, in addition to quality of mechanism, that the company expects to make the Columbia Six a distinctive car. Contracts for the first allotment of 2500 Columbia bodies have been placed with one of the largest and best body building concerns in the country, deliveries to be completed about June 15.

The Columbia Six weighs about 2150 pounds, and its price will be around \$900.



The New Columbia Six, the Components of Which Are Standard and High Grade and Which Will Sell for About \$900.



A subscriber writes that he has designed a spark plug which "cleans, cools and primes itself, as well as finds its own trouble." The design is shown in Fig. 180, this sketch being made from a blue print which the inventor submitted.

No. 1 is the cross piece in the steel body of the plug; No. 2 is the contact point which strikes the cross piece, 1 (above the end of the contact point is a small valve, 5, which has a stem extending the entire length of the plug); No. 3 shows the brass sleeve which also extends the entire length of the plug and connects with the priming cup at the top; No. 9 is the porcelain insulator which runs within $\frac{1}{4}$ of an inch of the priming cup; No. 6 is a lever designed to contact with the top of the valve, 5, and press it down on the cross piece, 1, thus short circuiting the plug. The upper dotted line shows the plug short circuited, while the dotted line, 7, illustrates the position of the lever under ordinary operating conditions. No. 8 is the priming cup fitted to the top of the brass sleeve, 3. The secondary wire connects to the plug at the point marked 10. The valve stem, 5, is .003 inch smaller than the brass sleeve, 3.

The intake stroke of the piston in the cylinder causes the valve, 5, to be drawn down and contact with the body of the plug, 1. Air is drawn through the brass sleeve, 3, and passes into the cylinder. Statement is made that the small volume of air passing the contact points keeps them clean and the porcelain cool. The upward travel of the piston on the compression stroke separates the points about $\frac{3}{64}$ of an inch and closes the valve. These operations occur at every

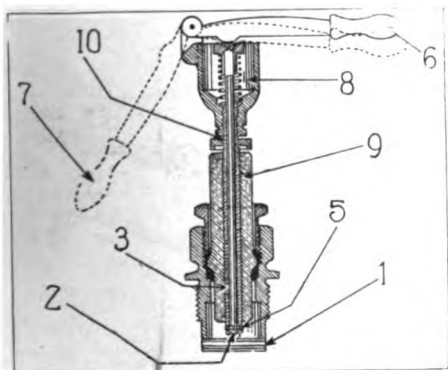


Fig. 180—Spark Plug Designed by Reader Which Is Automatic in Action.

suction and compression stroke of the piston.

To prime the engine, the gasoline is poured into the priming cup at the top. The suction stroke of the piston opens the valve and instead of air, the gasoline is drawn down the sleeve, pass the contact points and then ignited.

To locate ignition troubles the plug can be grounded by simply applying pressure to the valve by the lever at the top.

PRACTICAL LIGHT STAND.

One of the chief requisites of the repair shop or private garage is that there be a well lighted work bench. In Fig. 181 is shown a method of suspending the ordinary electric light to be of the

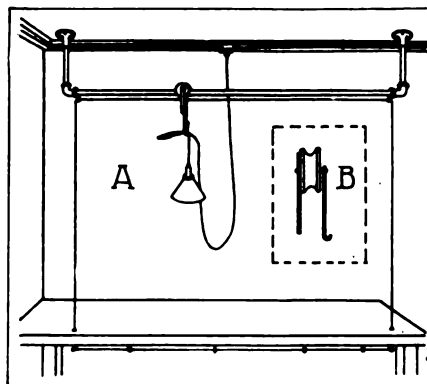


Fig. 181—Overhead Trolley Arrangement Which Allows the Light to Be Placed at Any Point Over the Bench.

greatest convenience to the work man. It consists of a light rack suspended from the ceiling and directly over the bench. The rack may be easily constructed of small gas piping, two standards and a like number of elbows. The illustration explains the construction clearer than words can. The horizontal gas pipe forms a rail on which a small grooved pulley is run. To carry the light and also prevent the pulley from falling off the rail, two arms, as shown at B, are fitted. A cable is then attached to the arms, placed through guides at the ends of the rail and then carried under the bench. Should work man be at one end of the bench and the light at the other, by pulling the cable, the light will be moved toward him. This equipment also makes for economy, as a single light may be used in the place of two or more.

HEAT PROOF PAINT.

A good heat proof paint for automobile cylinders and exhaust manifold can be made by mixing two pounds of black oxide of manganese, three pounds of flake graphite and nine pounds of Fuller's earth. To this mixture add a compound of one part of glucose, 10 parts of sodium silicate and four parts of water until the entire mixture forms a paint like consistency.

FREEDING THE EYE OF DIRT.

People who ride or do work on automobiles are very apt to get small particles of foreign matter in their eyes, and to prevent inflammation and other troubles it is imperative that these be removed at once. By gripping the upper eyelash with the fingers and placing a match against the eyelid, the latter may be turned up so that the inside is exposed. The "patient" should then move the eye up and down and to the left and the right. Wind a small piece of absorbent cotton around the end of a match and moisten it in clear water. The foreign particle can then be swabbed out, the object adhering to the swab.

DRILLING BLOCK.

U shaped parts are not easy to drill. In Fig. 182 is shown a drilling block made from a section of an old crankshaft. The journals are sawed off so that two cheeks are available for use on the table of the drilling machine. The block can be easily secured to the table by a wooden clamp.

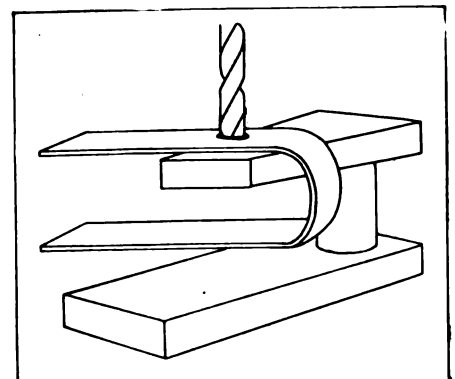


Fig. 182—Practical Drilling Block Made from Section of Old Crankshaft.

VALVE LIFTER.

Valve lifters can be made at slight expense. In Fig. 183 is shown a tool made by a work man from a piece of

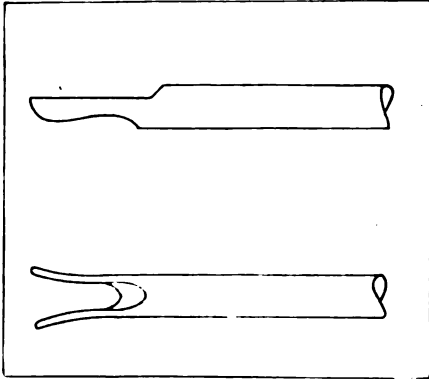


Fig. 183—Practical Valve Lifter Can Easily Be Made from Piece of Piping.

iron tubing. A hole was drilled through the piping about three inches from the end. The metal was then cut away with a hack saw as shown and the ends were sprung outwardly and filed smooth. When shaping the tool it is advisable to remove a trifle more material from the bottom than at the top. The greater amount of room is needed for the removing of cotter pins and retaining keys.

TESTING LUBRICATING OILS.

While the average motorist has not the elaborate equipment available to the chemist for testing lubricating oils, there are several simple methods by which he can arrive at practical conclusions regarding the quality of the lubricant without such equipment.

To determine if the oil contains solid impurities, fill a tumbler half full with it and add a sufficient quantity of kerosene until the whole becomes quite thin. Then pass the mixture through ordinary white blotting paper, after which wash the paper with kerosene. If the oil contains any solid impurities, there will be a residue on the paper.

Another method is to smear a piece of writing paper with the oil and then hold it to the light. If the oil is free from any solid impurity, the entire blot will be transparent, if not, the solid impurities will show.

A good grade of oil will not resinify. To conduct this test, pour a small quantity into a shallow dish and place it in a warm place for about a week. At the end of this period there should not be the slightest crust on the surface. Still another way to test it in this respect is to mix the oil with nitric acid fumes. A pure oil will form into a thick mass in a few hours, while resinifying oil will remain unchanged.

One of the most injurious impurities which a lubricating oil can contain are acids, which attack the metal parts of the machine. To test for them add copper oxide or copper ash and place in a glass vessel. A pure oil will retain its original color, while on the other hand, if it contains acids, the lubricant will become a greenish or bluish color.

Still another test for the same impur-

ity is to smear a little of the oil on a sheet of copper or brass and allow it to remain there for about a week. The presence of acid will be determined by a green spot on the metal. Blue litmus paper dipped in acid free oil remains blue, but changes to red if the oil contains acid.

To have a good lubricating effect an oil must be greasy. When the motorist is undecided as to the best oil to use in this respect, place a few drops of each on a smooth, slightly inclined glass sheet. The best oil will travel furthest in a given time.

REPAIR OF VALVE SPRING.

Large washers are handy parts to include in the equipment of the car. While running at a high rate of speed on a level country road, a motorist writes that the spring controlling the action of the front intake valve became broken. As this occurred in the centre, it was impossible to stretch it so that it would operate until a repair shop could be reached. The repair he made is shown in Fig. 184. The broken valve spring was removed and a large washer placed

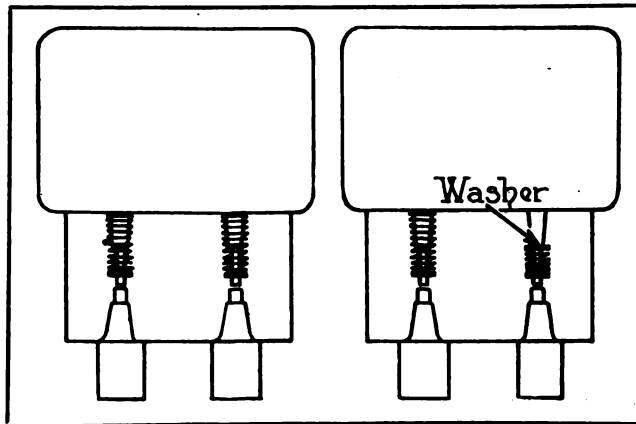


Fig. 184—Large Washer Placed Against Bottom of Valve Guide Affords Broken Spring Sufficient Tension to Properly Close Valve.

over the valve stem and against the bottom of the valve guide. A section of the broken valve spring was next placed over the valve stem and rested against the washer. The tension of the spring was then sufficient to properly operate the valve.

HANDY REFERENCE TABLE.

The speedometer has become standard equipment with nearly every modern automobile. This instrument expresses in miles per hour the speed at which the car is traveling. The operator can determine at a glance the exact distance which will be traveled in one hour if a constant speed is maintained, but it requires calculation to determine the time required to complete short distances, allowing that the machine is operated at a constant speed.

The accompanying table will be of service in ascertaining the time required to complete one mile at different speeds. The figures in the first column represent the miles per hour shown by the speed-

ometer, while those of the second show the time per mile in minutes and seconds:

M.P.H.	M.	S.	M.P.H.	M.	S.
10	6	00	11	5	27
12	5	00	13	4	37
14	4	17	15	4	00
16	3	45	17	3	33
18	3	20	19	3	09
20	3	00	21	2	51
22	2	44	23	2	37
24	2	30	25	2	24
26	2	18	27	2	13
28	2	09	29	2	04
30	2	00	31	1	56
32	1	53	33	1	49
34	1	46	35	1	43
36	1	40	37	1	37
38	1	35	39	1	32
40	1	30			

A UNIQUE ENGINE STAND.

It is more convenient for the repair man to do work on an engine that has been removed from the car if it be placed on a stand instead of the bench. In Fig. 185 is shown a stand made of a discarded car frame, the frame having previously been damaged by accident, so that it could not be repaired. The sketch depicts the construction better than words could. The corners are formed by cutting away the channel sides and bending the ends over. The construction is made rugged by riveting all jointed parts. For convenience when placing or removing the engine from the stand, one of the end pieces is not riveted in place, bolts being used instead. By removing the bolts the end piece can be taken off and the engine slid in place, thus eliminating the necessity of lifting. The front end of the stand remains the same as it was on the car.

When moving the car by hand it is poor practise to apply the force entirely to the steering wheel, as its components are apt to become strained.

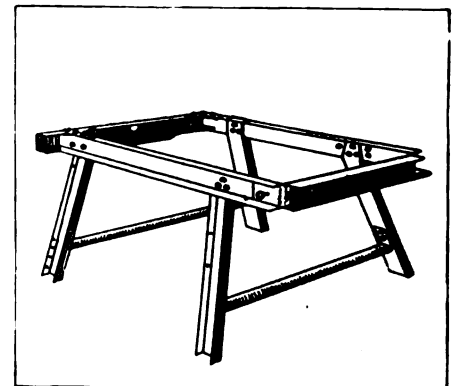


Fig. 185—Showing Engine Stand That Was Made from a Discarded Car Frame.

SUGGESTIONS FOR THE FORD CAR OWNER.

Practical Restoration of the Crankshaft When Worn and Scraping or Renewing the Main and Connecting Rod Bearings—Grinding the Valves and Ports.

The 48th article dealing with the operation, construction, maintenance, care and repair of the model T Ford chassis is the ninth of the series devoted to adjusting, restoration and overhauling.

CONSIDERING the condition of the engine bearings and what is necessary to restore them to the original state of efficiency, the owner should understand that there should be no play of the crankshaft in the bearings.

Assuming that the shaft at first exactly fitted the bearings, the friction of the steel against the softer babbitt metal will wear it, and the weight and the force of the explosions on the pistons will cause the shaft to bear upon the lower halves. Of course the surface of the bearings that carry the load is approximately a half of the entire area, or at least is that in theory, and supposition is logical that wear should be equal. But the experience from practise is that the bearings are not equally worn.

The seats of the main bearings in the engine block are machined to dimensions, and at the tops of the seats are holes, one in each of the front and rear bearings and two in the centre, for the admission of oil that descends by gravity into them. The bearing linings of babbitt metal are approximately $\frac{5}{64}$ or $\frac{3}{32}$ inch thickness, and are retained in the seats of the casting or the caps by stubs or bosses that fill three holes on either side, close to the edges. These holes are $\frac{1}{4}$ inch diameter, about $\frac{3}{16}$ inch depth, at angles to the dividing lines, and the bosses of the lining when poured into the seats practically fill them. The linings are securely anchored and there is no probability of their loosening, no matter what the degree of wear.

The linings of the connecting rods are babbitt metal and they are similarly anchored in the rods and caps. These bushings are somewhat thicker than the main bearing linings because they are not as large in area and they are subjected to very high pressure.

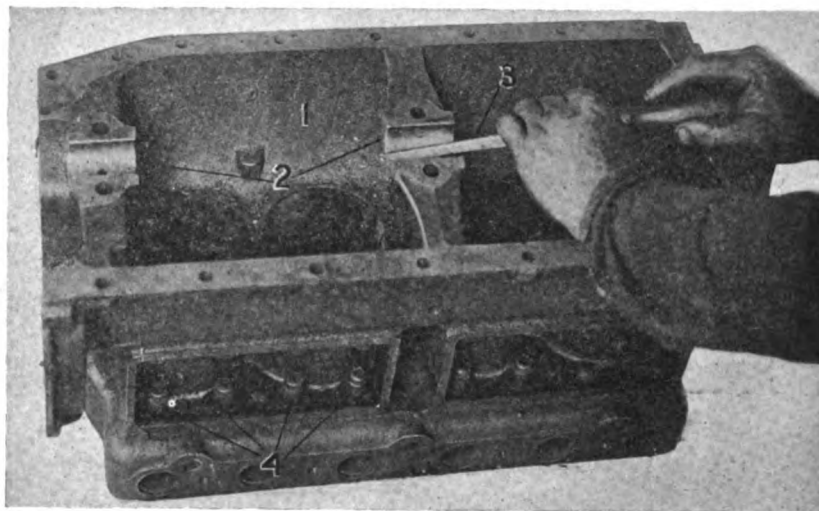
Some Phases of Bearing Wear.

With continued wear the crankshaft main bearings may show a series of very small ridges and grooves in transverse direction, indicating that the cause was abrasive substances which were carried around between the shaft and the bushings, the height and depth depending upon

the degree of service and the character of the lubrication. In some instances the crankshaft will have similar ridges and grooves on its surface. Such conditions are seldom met with, because they could only result from neglect or failure of lubrication.

Usually the wear on the bearings results from what is known as side pressure, the weight of the flywheel and transmission gearset bearing down on the rear end of the rear bearing and in lesser degree on the rear ends of the centre and front bearings, and upward on the forward ends of all three bearings. This wear in time enlarges the bores of the bearings at the ends and the shaft will rock or play in them, causing pounding or knocking.

Any movement of the crankshaft is transmitted in at least the same ratio to the connecting rods, and the bushings of the big ends are simi-



Restoring the Engine Block Halves of Main Bearings.

- | | |
|------------------------|--------------------------|
| 1—Cylinder Block. | 3—Bearing Scraping Tool. |
| 2—Crankshaft Bearings. | 4—Valve Guides. |

larly worn, but as the bearings are shorter the degree of wear will be greater. The continual explosions in the cylinders will necessarily affect the bushings in the rods in much the same manner as they do the linings of the caps of the main bearings. The bronze bushings for the wristpins are large and do not wear quickly, but they will eventually become enlarged.

Two Means of Restoration.

Restoration of the worn bearings is possible in two ways—by replacement of the babbitt linings or by reduction of the bores until a uniform contact, such as originally existed, is obtained. There are those who will maintain that new babbitt metal can be cast into the seats in the engine block, caps and connecting rods, but while this

is practical if one has the necessary equipment and experience, the average owner cannot expect to renew bushings. Only in Ford service stations and in the large shops where the facilities must be utilized in bearing repairs to a considerable extent can this work be well done. The man who undertakes this repair without first class mechanical knowledge and experience will probably throw away his time and labor and have to eventually take the engine to a shop, because no makeshift will suffice, and the work must be thorough and accurate.

The statement may be added that there are many factors that influence perfect work, including heating the casting, the temperature of the babbitt must be such that it will flow freely and not be burned, the casts must be vented to obtain solid metal, and there must be no shrinkage. In the event that the babbitt cannot be uniformly surfaced the engine block had best be taken to a shop for rebabbiting. The main bearing caps

pound. No one not skilled in machine or mechanical work should undertake this, and care should be taken to polish the shafts. Emery should not be used, as particles of this abrasive may stick in the surface of the shafts and cut the bearings very rapidly. This is essentially a shop job.

Refitting the Bearings.

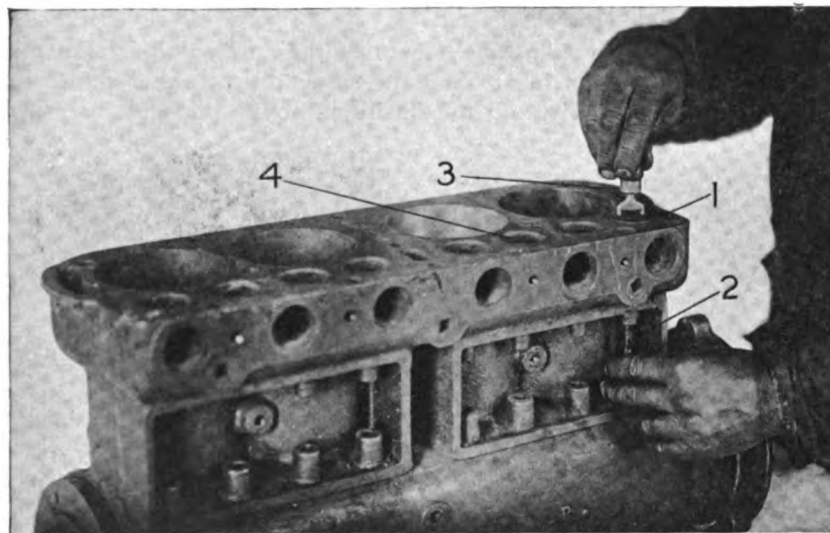
The bores of the bearings may be reduced in two ways. The edges of the engine block castings, against which the caps of the main bearings seat, may be draw filed evenly and the seats of the caps themselves similarly treated. There is a possibility that removal of shims will suffice, but there should be some shims between the caps and the block to provide for adjustment later on.

The crankshaft should now be thinly coated with a paste of Prussian blue on the main pins, placed in the block and the bearing caps well tightened. The shaft should be turned several times and the caps loosened and the shaft taken out. At every part of the linings that contacts with the shaft blue will show. With scrapers that are usually made from three-corner and half-round files annealed, ground and tempered, and shaped so that they can be used on very small areas when necessary, the "spots" will be scraped away evenly in all directions from the centres of the spots. One or three bearings can be worked on. The purpose is to reduce the uneven surfaces of the babbitt to as nearly even surfaces as can be obtained.

Great care is necessary, for a cut of metal 1/1000 inch will cause a low place in the surface.

The skilled worker removes very thin chips and tests the results frequently. The process may appear slow, but the probability is that too much metal will be cut away, for the babbitt is very easily worked, unless the shaft is often tested. The bearing is only perfect when practically all of the surface of the lining contacts with the shaft, the full length and width. With experience a work man can very closely judge the points and the areas to be scraped to even the surfaces of the babbitt. The best advice is to make frequent tests and cut very thin. Metal that has been scraped away cannot be replaced and there is no need to waste it by carelessness.

When tests of the bearings are made the shaft should be turned with one cap well tightened with one hand. Work had best be begun with the rear bearing cap in place, the cap bolts being set as firmly as possible with it stripping the



Grinding the Valve with Small Hand Tool.

1—Valve Head (Seated).
2—Valve Stem.

3—Valve Grinding Tool.
4—Valve Port.

can also be rebabbiting, but there does not seem to be a great deal of economy in this, as new caps can be purchased very cheaply and one is assured that they will be equal to the originals.

Exchange Expense Very Small.

The connecting rods and caps can be exchanged at any Ford branch by the payment of approximately half the cost of new, and the expense is so small that the owner had best make the exchange rather than undertaking to rebabbit them. The renewal of bushings in the piston bosses is the only practical means of restoration.

When the crankshaft and camshaft have been taken out of the block and tested for truth and restored if this is necessary, the main and crank pins of the former and the main pins of the latter should be made perfectly smooth and round. This can be done by grinding or by hand work by strips of cloth or leather and a grinding com-

threads. The caps should always be put on so that the punch marks on them correspond, which will insure uniformity of test throughout the work. The same number of shims should always be used in the tests, and if the shaft is too snugly fitted the addition of a pair will possibly afford the right fit, or if too free, the removal of a pair will perhaps insure the right adjustment.

What has been stated applies equally well to the fitting of the connecting rod bearings. The caps of the connecting rods can be seated closer by draw filing the seating faces, inserting shims and after replacing the caps so that the punch marks correspond, tightening the bolts.

Tests for Piston Parallelism.

The fit of the connecting rods can be determined when the engine block is in the chassis by turning the engine by hand, but if new rods are fitted to the crankshaft care should be taken to see that the pistons are exactly at angles of 90 degrees to the crank pins. The caps may be regarded as sufficiently tight if the pistons will slowly fall from a vertical position when released.

The best test of the parallelism of the pistons is to clamp the shaft in a vise and try it with a spirit level until perfectly horizontal. This insures the position of the shaft. With the connecting rod tightened a straight edge can be placed across the tops of the pistons. Measurement with an adjustable height gauge can be made at either side of the straight edge, or if the piston is removed from the wristpin the test can be made at either side of the wristpin. If the crankshaft is exactly level when held in the vise the relation of the piston can be determined by placing a level on its top.

There is possibility of getting the bearings too tightly set, which would result in heating and destruction of the linings. When the shaft is to be replaced in the block the shaft and bearings should be coated with lubricating oil, which will prevent the bearings too closely contacting with it. One should remember that the bearing caps should seat on the shims and yet fit evenly throughout.

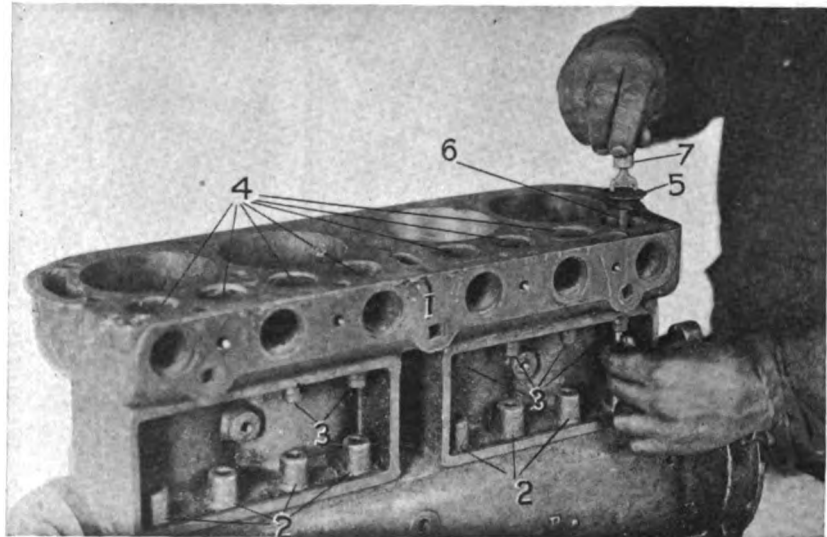
Grinding the Valves.

Grinding the valves is a work that requires care and patience. No valve is serviceable unless it is straight and the head true. If warped, a valve had best be discarded, but if the stem is bent it may be straightened. A good grinding compound is desirable, and this may be in two grades or qualities, a rough quality for cutting and a finer one for finishing. The valve should

be placed in the seat with the edges coated with the compound. With a small tool it should be given about a quarter turn backward and forward, the handle of the tool being rolled between the fingers, and at frequent intervals the valve should be lifted clear of the seat.

This will soon cut away the metal of the seat and the valve. The position of the valve on the seat ought to be changed after each half dozen rolls of the tool, as it may be every time it is lifted with the fingers, as shown in the accompanying illustration. If the valve is revolved the seat may be cut in circles, which will necessitate additional grinding to remove, and possibly the retiming of the valve. The grinding compound should be used in very small quantities and often applied. No pressure should be applied to the tool other than to keep its fork in the holes in the valve head.

While grinding the valves one had best place a ball of waste attached to a string in the valve



Raising the Valve from the Port by the Hand.

1—Cylinder Block.
2—Tapper Guides.
3—Valve Guides.
4—Valve Ports.

5—Valve Head.
6—Valve Stem.
7—Grinding Tool.

pocket to prevent any abrasive being worked into the pocket and thence into the cylinder, and the valve and seat should be carefully cleaned with gasoline when the grinding is completed.

(To Be Continued.)

DR. ROWE HEADS A. A. A.

Directors of the American Automobile Association at the recent session at Washington, D. C., elected Dr. H. M. Rowe of Baltimore to the presidency, to succeed John A. Wilson of Franklin, Penn. One of the important developments of the meeting was the almost unanimous opinion that the government should direct a nation wide good roads movement. The next meeting of the directors will be held at Cleveland.

MOTOR CAR ACCESSORIES AND EQUIPMENT.

BRAKE WAFERS.

The safety of the car and passengers is reliant upon the efficiency of the brakes. Brake lining when oil or water soaked,



or worn, will cause slipping and squeaking and operation under these conditions is dangerous. The purpose of the Rex anti-slip brake wafer is to make the automobile brakes silent and sure in action. It is a tablet about the size of a silver quarter, will not injure any kind of brake lining and should be used at first signs of brake slipping. The wafers are also designed to prevent slipping of cone clutches, fan and magneto belts and all friction gripping surfaces.

Manufactured by the Armiger Chemical Company, 2155-57 Austin avenue, Chicago, Ill. List price, 50 cents per can of 25 wafers.

STEARNS EMERGENCY CASE.

Illustrated herewith is the Stearns emergency case, which presents in neat and compact form such mechanical and medicinal articles as are most likely to be of use and of service to motor tourists. It is intended to render first aid service and the medicines are for minor ailments. In no manner is it intended to displace the services of a physician.



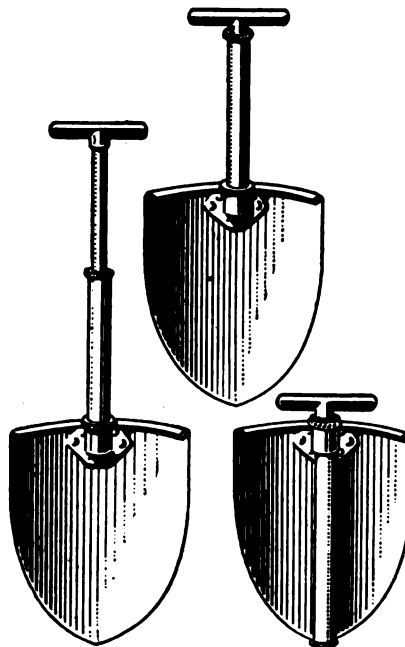
The case contains eye water, headache tablets, laxative, diarrhoea and cramp tablets, analgesic balm, indigestion tablets, alphozone dusting powder, rhinitis tablets, toothache plug, compound mus-

tard ointment, absorbent cotton, surgeons' plaster, court plaster and gauze bandage.

Manufactured by Frederick Stearns & Co., Detroit, Mich. List price, \$1.50.

TOURIST SHOVEL.

The shovel is one of the oldest and most useful of all implements used by man. It is particularly valuable when touring and has often been the means of preventing a lengthy stall by the wayside. Some motorists, however, prefer to omit this essential because of the inconvenience of carrying it. There is now made a shovel which has a telescoping handle. It is sold under the trade name of the Ideal tourist shovel. An interesting feature of the construction is



that the handle is adjustable, so as to obtain a short or half handle, or a full length handle. The handle can be telescoped into the hollow part of the blade, thus affording a compact shovel that can be carried in the tool box of any automobile. The implement is of all steel construction and is guaranteed to be strong, durable and efficient.

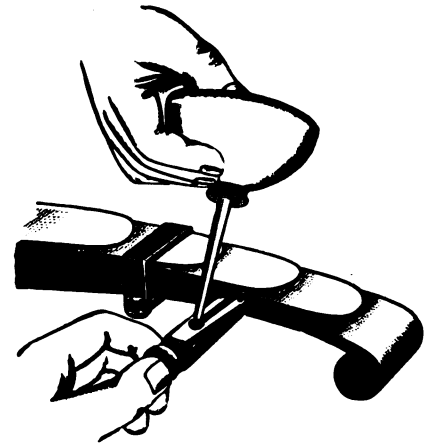
This is an ideal shovel for motorists, campers, prospectors, surveyors and, in fact, for all general purposes by reason of its compactness and light weight.

Manufactured by the Ideal Manufacturing Company, North Kansas City, Mo. Write for descriptive circular and price.

COCHRAN SPRING OILER.

The life of the car springs will be materially shortened if ample lubrication is not afforded the spring leaves. The purpose of lubrication between the leaves is to reduce friction so that the leaves can slide over one another, absorb the shock, resist breakage and reduce wear and tear due to vibration. There are numerous methods of inserting the lubricant

between the leaves, but by the use of the Cochran spring oiler, illustrated herewith, the operation is made simple, rapid and efficient. It is first necessary to relieve the spring of its load by plac-



ing a jack under the body. The wedge shaped oiler can then be driven between the leaves and the oil applied freely and easily.

Manufactured by the Cochran Pipe Wrench Manufacturing Company, 7800 Woodlawn avenue, Chicago, Ill. Write for price and literature.

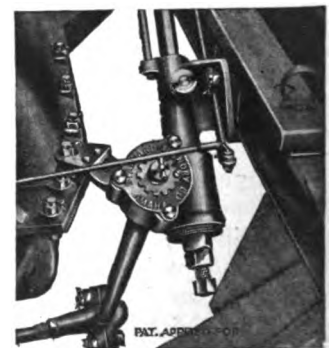
SU-DIG SERIES PLUGS.

Su-Dig series plugs are designed to be connected in series with the regular plugs, resulting in the producing of two simultaneous sparks in each cylinder. Their use requires no change in the battery or magneto system. Installation is effected by drilling and tapping the exhaust valve caps and inserting the plugs. The advantages claimed for the double spark are instant combustion, more power, greater gasoline mileage, less carbon deposit and less gear shifting.

Manufactured by the Superior Motor Power Company, 28 Irving place, New York City. List price, \$1.50 each.

IRREVERSIBLE STEERING GEAR.

By installing the irreversible worm steering gear, illustrated herewith, Ford



owners are permitted to have the same steering control of the machine as is possible in higher priced cars. With this mechanism it is impossible for any irregular road or other condition to pull

the steering wheel from the operator's hands. It provides an added element of safety.

Statement is made that it requires about an hour's work to take off the old



device and attach the irreversibly steering gear.

Manufactured by the Standard Foundry Company, 606 South 14th street, Omaha, Neb. List price, \$11.

ECONO-LUB GREASE GUN.

Econo-Lub is a high-grade grease lubricant for automobiles. It is made in two grades, the No. 3 being for compression cups and rear axle use, while the No. 2 grade is more fluid and preferred by many for transmission and rear axle lubrication.

One feature is the packing of this lubricant in small grease guns, as shown in the accompanying illustration. The gun operates by removing a tin cap at the bottom and forcing a wooden plug through with a stick. The advantage of this arrangement is that there is no waste, no dirt made and the greasing operation is easily and quickly accomplished. The charged gun ready for use weighs one pound gross.

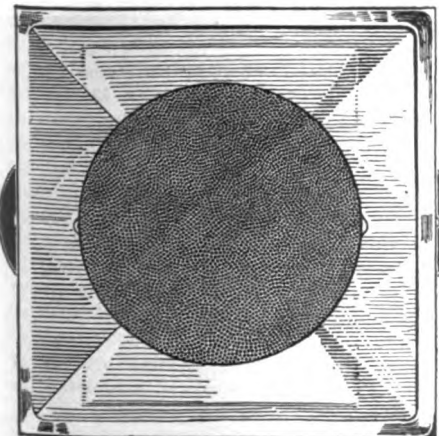
Manufactured by the Middle States Oil Company, Cleveland, O. Write for prices.

LIGHTLESS TAIL LIGHT.

The new safety first lightless light, illustrated herewith, is designed to be attached to the rear of the automobile, carriage or other types of vehicles. This device will give forth a bright red light whenever the rays of an oncoming headlight strike its focal surface. The first cost is the only expense, as it burns no fuel and is never out of order.

The light is constructed with the utmost care and none but the best of materials enter into its manufacture. The sensitive mirror surfaces are accurately adjusted and carefully turned and set to the proper degree. This assures perfect refraction and an absolute concentrated focus.

Manufactured by J. T. McGrath & Son, Bloomington, Ill. List price, \$1.

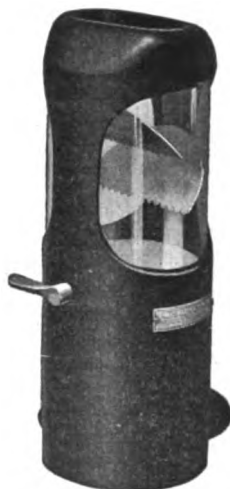


JITNEY FARE BOX.

The Caille jitney fare box, illustrated herewith, requires no operator and is absolute protection against loss or theft. It is designed to fit any convenient place in the jitney 'bus and will successfully handle the collection of fares. The box is made in two sizes, 12x4½ inches and 8x4 inches. It is entirely of iron, enamelled in black or any color desired.

The bottom part incorporates a cash drawer, which is secured by a Yale lock. The slot at the top is so arranged with deflectors that it is impossible to extract a coin or ticket after it has been placed in the box. An attachment is furnished for convenient fastening to any part of the machine.

This fare box was primarily designed



to efficiently handle the fares of all patrons of the jitney 'bus, but it can also be used successfully for almost any other similar purpose. It is weather, fool and wear proof.

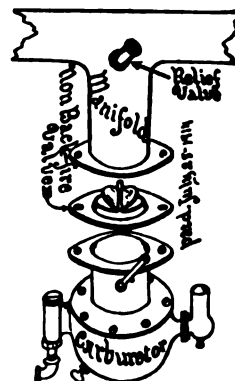
Manufactured by the Caille Brothers Company, Detroit, Mich. Write for prices and literature.

NON-BACKFIRE VALVE.

The Safety First Non-Backfire valve can be applied to any make of automobile. It combines a primer, carbon remover and gasoline saver. Under ordinary engine operation, the suction created by the pistons easily lifts the valve lips and does not impede the free passage of the gas from the carburetor to the cylinders. When motor operation ceases the lips automatically fall and retain the gas mixture in the manifold pipe, thus facilitating starting and saving gas by preventing evaporation.

As a primer, gasoline is squirted through this valve, where it is retained by another just underneath until the engine is started; it is then drawn into the cylinders. To loosen carbon, squirt about a half ounce of kerosene or alcohol through the relief valve while the motor is hot, after which the engine should be turned over a few times by hand. When the motor is again started and warm, about a quart of water may be slowly taken in through the relief valve. This will thoroughly loosen the carbon so that it can be expelled with the exhaust.

The chief value of the valve, however, is the protection afforded the car against destruction by fire. In the case of back fire the pressure closes the lips and prevents the flame from reaching the gaso-



line in the carburetor. The escape is through the relief valve shown in the illustration.

The valves are made in three sizes, 1, 1½ and 1¾ inches, to fit all standard carburetors.

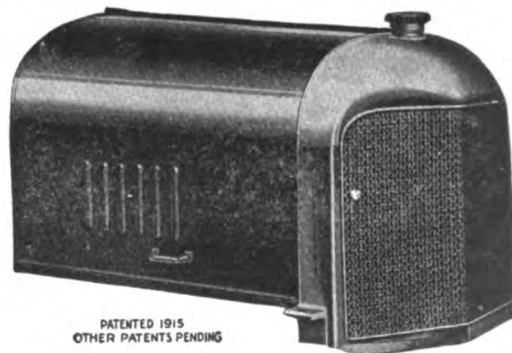
Manufactured by the Safety First Valve Company, Wyoming, Ill. Full description and price on request.

EQUIPMENT FOR FORD CARS.

It is now possible to obtain for the Ford car the same streamline appearance that is a distinctive feature of the higher priced cars. The National Zig-Zag radiator shown herewith is constructed on a principle that adds much to the cooling efficiency of the car. The water cells are arranged in zig-zag columns from top to bottom. The hot water enters at the top and flows slowly down in thin streams, being cooled by the air passing on the outside cells. These cells are made of continuous bands of sheet brass, forming one compact and strong unit. The radiator has a water capacity of four gallons. An extended crank is supplied to clear the radiator. It is easily substituted for the old one by removing a pin.

The hood is highly enameled in black. At each side are six ventilators. Concealed everlasting side hinges extend the full length of the hood and provide a smooth finish. A neatly formed heavy steel hood ledge completes the equipment. It is enameled in black and taped to prevent rattling. This ledge is not required for the Ford cars having a sloping cowl dash.

Manufactured by the National Can Company (Radiator Department), Detroit, Mich. Write for details.



PATENTED 1915
OTHER PATENTS PENDING

NEW TRANSCONTINENTAL RECORD.

With Eight Cylinder Cadillac, Baker Travels Nearly 4000 Miles in Approximately 190 Hours.

E. G. Baker, the long distance automobile and motorcycle driver, who has many records to his credit, recently broke again the record for coast-to-coast driving by reaching New York 7½ days after leaving Los Angeles, Cal., traveling 3380.7 miles during that time. The car was a Cadillac Eight roadster.

The former record was 11 days, seven hours and 15 minutes, made by Baker with the same observer, W. F. Sturm of Indianapolis, in a Stutz "Bear Cat." On that trip the distance covered was 3728.4 miles. Road improvement in the meantime has doubtless made possible a shorter route. Baker himself drove the entire distance, getting only 19 hours sleep during the entire trip.

Deplorable road conditions and much mud delayed the car and Baker declares he could have made the distance in one day less had it not been for adverse weather. The hardest riding was in Missouri, where in one place the car was able to make only 10 miles in two hours. The longest distance covered in a single day was 567.2 miles, on the third day's run into Dodge City. The total of the three days was 1655.9. This was at the rate of 551 miles daily, or 20.9 miles for every hour of the 24.

Fast railroad trains require 90 hours between Los Angeles and New York and use more than 20 engines for the distance. Between Barstow and Needles trouble was experienced with a leaky oil pipe and this cost the driver 2½ hours. The car made between nine and 10 miles per gallon on the average in spite of much low gear work.

TWO-BASE HIT WINS OVERLAND.

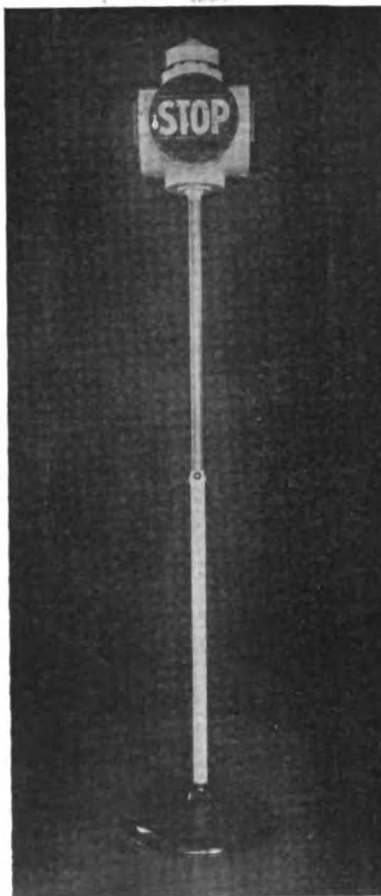
On June 1 Fred Merkle, the popular first baseman for the New York Giants, will receive a six-cylinder Overland of special design as a reward for having hit the C. T. Silver sign at the Polo grounds, New York City's National League ball park, with a batted ball. This is the first time the sign has been struck in that manner in two years, although it is only 342 feet from home plate. Though the hit was only a "two-sacker," it netted Merkle an Overland car, including wire wheels, slip covers, extra tire and tube, special lamps, luvres in hood, bumper, extra wire wheel mounted on a spindle. The car is painted a beautiful shade of brown and represents a value of \$1485.

SAFEGUARDING BOSTON TRAFFIC.

The street commissioners of Boston, Mass., are considering the adoption of a new development in traffic signals, which bears the distinctive name of Dincox, Jr. This signal is of the semaphore type, and is the successor of Dincox, Sr., which a few months ago was damaged by an automobile while stand-

ing sentinel at the junction of Summer and Tremont streets. The city officials of Brookline, Mass., have already adopted the signal, installing it at one of the most dangerous corners of that thoroughfare.

Dincox, Jr., like the original semaphore, is the invention of Attorney Charles H. Morris of Boston and differs from the type in use in New York City in that it can be used either day or night. This is feasible through the fact that it has a light mounted on the top with the words "Stop" and "Go," which can be illuminated by either oil or electric light. The device has a telescope arrangement,



Dincox, Jr., the Traffic Signal Now in Use in Brookline, Mass., Which May Be Adopted for Boston Traffic Regulation.

which allows for a four-foot variance in height to meet the conditions of traffic. In service the traffic officer stands beside the semaphore, regulating traffic by turning the light to show which ever signal he desires, he doing this by means of a short handle located at about the height of his waist.

The semaphore is movable, standing on a broad iron base, and after rush hours it can be carried easily to some nearby place for storage during the night hours.

RACERS USE BOSCH MAGNETOS.

One of the distinctive features of the equipment of the racing cars that took part in the contests at Sheephead Bay, May 13, was that every car, excepting the two Delages driven by Limberg and Devigne and the Hudson piloted by Vail, was provided with Bosch magneto ignition. This type of ignition has proven very popular with the racing drivers, as is indicated by the Bosch company's pamphlet entitled "Conclusively Convincing," where it is shown that the cars that came in first in 26 of the races of the 1915 season were equipped with Bosch ignition. This pamphlet is of particular interest to race followers, it showing the winners of the races, the cars, the distances and the average miles per hour made in each. It is sent free upon request addressed to the Bosch Magneto Company, 223 West 46th street, New York, N. Y.

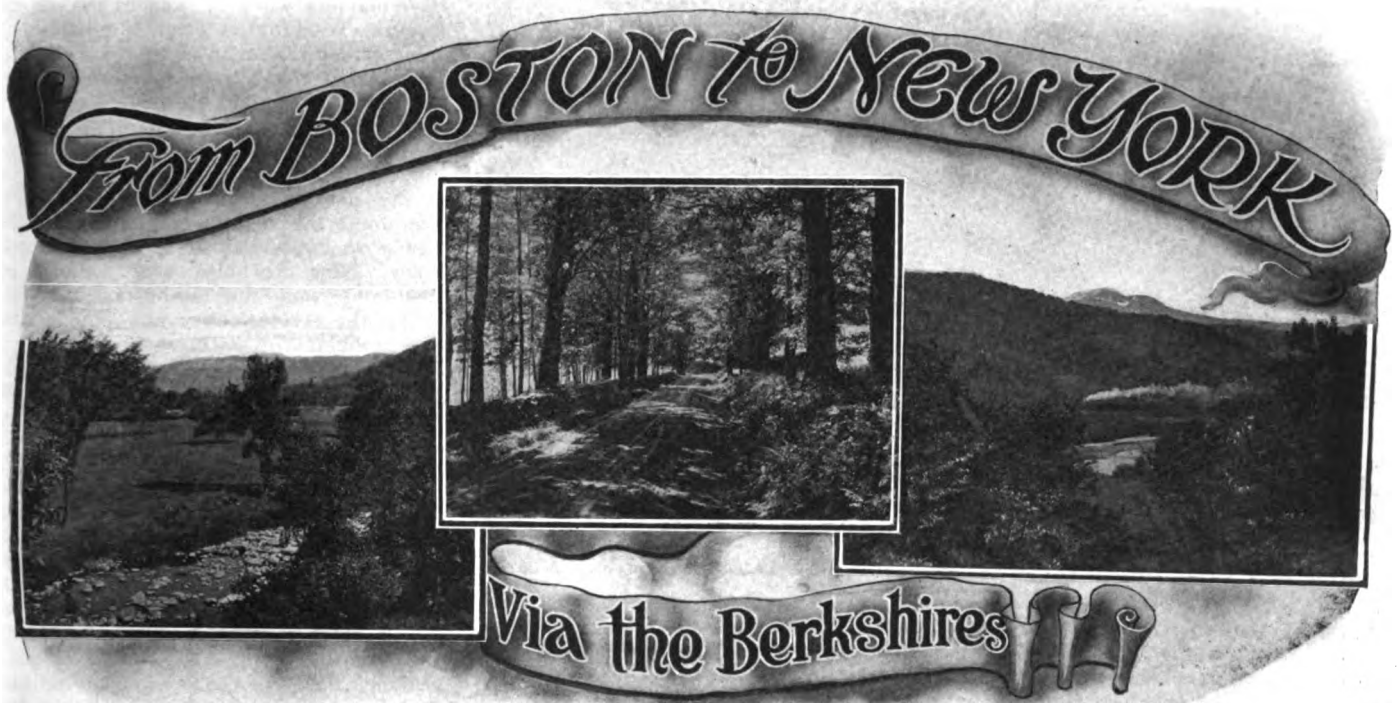
MASSACHUSETTS CLUB ELECTS.

At the recent meeting of the directors of the Massachusetts State Automobile Association at Boston, John P. Coughlin of Worcester, one of the pioneer motorists of Massachusetts, was chosen president to fill the vacancy created by the death of L. H. Speare, the former incumbent. George W. McNear, president of the Bay State Automobile Association, was elected vice president, while both Mr. Coughlin and Mr. McNear, together with Secretary Fortesque and C. W. Renwick, were chosen as delegates to the convention of the American Automobile Association at Washington, D. C.

The association indorsed the movement to make the highways safer by having all its members report flagrant abuses of the motor laws and bring them before the Highway Commission. President Coughlin and Professor Gallup of the Worcester Polytechnical Institute were appointed a committee to consult the Highway Commission on a plan to have motorists who are not obeying the light law to do so, and also to devise some means whereby both motorists and policemen can be informed how to focus bulbs so as to bring various devices within the law.

EMPIRE SETS COAST RECORD.

From Los Angeles to Oakland, Cal., in 10 hours and 21 minutes is the latest record established by an Empire Six stock car. The distance is 446 miles and most of it is over mountain roads. The average speed per mile was 43.09 miles per hour, which has been accepted on the Pacific coast as the record, it bettering the best previous speed by one mile per hour. The only way in which this car differed from any other Empire stock model was that the fenders, windshield and top were removed before the start. R. M. Crawford, Empire dealer in Oakland, and Jimmie Kirkland, well known as a transcontinental driver, alternated at the wheel. Three newspaper men, acting as observers, completed the party.



FOR the motorist who while traveling from Boston to New York, or vice versa, is more interested in mountain and lake scenery than in the coast line, a three-day trip is now possible over the very finest roads through the Berkshire hills and over the Mohawk Trail, passing the famous Hoosac or Florida mountain.

The 40 miles of road completed through the mountains from Greenfield to North Adams lies in a country of remarkably impressive beauty and wonderful views. It was built by the Massachusetts State Highway Commission and is one of the finest achievements of road building that has been accomplished in the United States.

From Boston the route runs along Massachusetts avenue and Commonwealth avenue, passing Harvard college and Washington elm. Two old churches of note, the First Parish church and Christ church, which was built of material brought from England and contains a very fine set of old chimes, are passed in Cambridge.

Through Arlington the route continues and comes shortly to Lexington, made famous by the first skirmish of the Revolutionary War. The Monroe tavern, which was the headquarters of Earl Percy, the British commander on that occasion, is still stand-

ing. On Lexington Green, where the battle took place, each point is designated by a marker or monument, the chief one being the figure of a "Minute Man" standing on a pile of rocks.

In the old burying ground is the grave of John Hancock. There is still to be seen also the old Hancock-Clark house in which Hancock and John Adams were sleeping when they were aroused by Paul Revere.

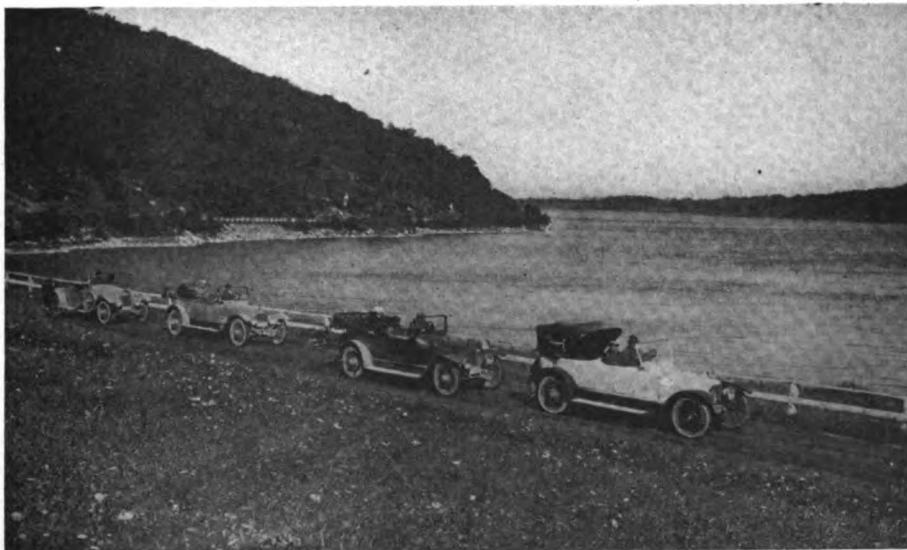
Concord, famous for its literary associations, is seven miles further on. Here Emerson, Hawthorne, the Allcotts and Thoreau had their homes. Grapevine cottage, where is the arbor on which Concord grapes were first grown, is one of the land marks. The houses of the famous writers of the Concord group are still standing.

Groton, which is the seat of a famous boys' school, is passed and the New Hampshire line is reached. Nearby is Mt. Monadnock, which is 1736 feet high. The night can be spent at Keene, N. H., and from there the road runs along the Ashuelot river to Hinsdale, where it turns up the Connecticut river to Greenfield.

Here the Mohawk Trail begins. This trail is said to have been used by the Indians in the time of King Philip as a thoroughfare from the Hudson to the Connecticut valleys.

Out of Greenfield the road goes along the Deerfield river to Shelburne Falls to a point two miles beyond Charlemont. There it turns up a winding climb of the eastern slope of Florida or Hoosac mountain. The road zig-zags along the side of Cold Brook. The grade nowhere exceeds nine per cent. because of the excellent construction. The surrounding country was practically impenetrable before the road was constructed and it is very wild and thickly wooded. Whitcomb summit, where a flag marks the top of the mountain, is 29 miles out of Greenfield.

From here on the road is all down grade until the valley is reached. There is one sharp turn blasted out of the rocky side of the mountain, but the road is smooth and so wide that it is



A Great Variety of Scenery Prevails Along the Majority of Motor Routes in New England and Neighboring New York.



General View of the Topography of the Berkshire Hills, This Road Being a Feeder to the Trunk Route.

not dangerous to traffic.

From the top of the ridge the traveler gets one of the finest views in America. On a clear day the entire expanse of the Berkshires is spread out before the motorist with Mt. Greylock in the foreground and the Catskills in New York, nearly 100 miles away. Below are the red tiled roofs of North Adams shining in the sunshine.

Williamstown, the site of Williams college, one of the better known small colleges of the country, is the next town of importance, and from there the tourist goes through South Williamstown and Lanesboro to Pittsfield, the centre and metropolis of the Berkshire region. The town was settled in 1752 and was named after William Pitt, the English premier, who was regarded as a friend of the American colonists.

Lenox a Famous Summer Resort.

Beyond is Lenox, a famous summer resort, with many fine hotels, and beyond that Sheffield and Ashley Falls, where there are important marble quarries. The road passes along the Housatonic river. Then comes Canaan and Haystack mountain. At the junction of the Mad and Still rivers is Winsted.

Thomaston, beyond, has been made famous by the great clock works of Seth Thomas. Thence the road follows the gradually widening Naugatuck river to Waterbury, which gave its name to a famous watch with an interminable spring.

Ansonia is a beautiful industrial city, where are foundries of the American Brass Company and many old time colonial mansions. The road follows the picturesque Housatonic valley to Stratford.

This is on the old Boston post road, over which the mails were carried in the early days. When Benjamin Franklin was postmaster-general he is said to have marked it off with mile stones set with the aid of a rude odometer, which he made and attached to his cart.

Bridgeport is a famous industrial city, made still more famous by P. T. Barnum, who was born and who made his headquarters there. Barnum's circus

still goes into winter quarters there. He gave the city a fine park in which there is a statue of himself. Elias Howe also lived in Bridgeport and invented the sewing machine there. He also has a monument in Seaside park.

Norwalk, Conn., was burned by the British during the Revolution, but many of the quaint pre-Revolutionary houses have survived. At Darien the Rev. Moses Mather and his congregation were captured by the British in 1781. His little old brick church still stands by the old post road.

Greenwich is the last town on the route in New England. The old home of General Putnam still stands on Putnam avenue. Down the steps of stone in front of the house he drove his horse to escape the British under Tyrone. Millbank, Boss Tweed's old estate, is nearby.

The Boston Post Road Inn at Mamaroneck is a hostelry of famous associations. It was used by General Howe as

headquarters when he was in pursuit of General Washington after the battle of Long Island. Nearby is where J. Fennimore Cooper was born and wrote many of his famous Indian stories.

The towns along this part of the shore of Long Island sound are largely residential suburbs of New York City. Rye is the site of the Haviland Inn, which was doing business in Colonial days and which was referred to in Washington's diary. New Rochelle was founded in 1686 and was the home of Thomas Paine, the revolutionary philosopher and free thinker.

BOSTON TO NEW YORK VIA THE BERKSHIRE HILLS.

Boston-Keene—87.5 Miles.

	Miles to Total	Out turn	Re-
Boston	0.0	0.0	87.5
Cambridge	3.6	3.6	83.9
Arlington	3.3	6.9	80.6
Lexington	5.0	11.9	75.6
North Acton	13.5	25.4	62.1
Littleton Common	2.9	28.3	59.2
Groton	6.9	35.2	52.3
Townsend	8.2	43.4	44.1
West Townsend	2.0	45.4	42.1
Ashby	4.6	50.0	37.5
West Rindge	12.9	62.9	24.6
Jaffrey	5.1	68.0	19.5
Marlboro	14.9	82.9	4.6
Keene	4.6	87.5	0.0

Keene-Great Barrington—123.0 Miles.

	Miles to Total	Out turn	Re-
Keene	0.0	0.0	123.0
W. Swanzey	5.4	5.4	117.6
Westport	2.4	7.8	115.2
Winchester	5.3	13.1	109.9
Hinsdale	5.7	18.8	104.2
E. Northfield	6.5	25.3	97.7
Northfield Village	1.0	26.3	96.7
Bernardstown	6.1	32.4	90.6
Greenfield	6.6	39.0	84.0
Shelburne	5.2	44.2	78.8
Shelburne Falls	3.9	48.1	74.9
Charlemont	8.7	56.8	66.2



Section of the Mohawk Trail Where Generally the Roads Are Excellent and the Scenery Inspiring.

Whitcomb Summit	11.3	68.1	54.9
North Adams.....	7.3	75.4	47.6
Williamstown	5.4	80.8	42.2
S. Williamstown..	5.4	86.2	36.8
Lanesboro	11.6	97.8	25.2
Pittsfield	5.3	103.1	19.9
Lenox	6.6	109.7	13.3
Stockbridge	5.9	115.6	7.4
Great Barrington.	7.4	123.0	0.0

Great Barrington-New York—144.6 Miles.

	Miles to	Total	Out turn
Great Barrington.	0.0	0.0	144.6
Sheffield	6.2	6.2	138.4
Ashley Falls.....	4.1	10.3	134.3
Canaan	2.2	12.5	132.1
Norfolk	7.7	20.2	124.4
Torrington	15.4	35.6	109.0
East Litchfield...	3.0	38.6	106.0
Thomaston	7.2	45.8	98.8
Waterville	7.0	52.8	91.8
Waterbury	2.8	55.6	89.0
Naugatuck	5.1	60.7	83.9
Seymour	7.3	68.0	76.6
Derby	5.6	73.6	71.0
Shelton	0.3	73.9	70.7
Stratford	9.8	83.7	60.9
Bridgeport	3.7	87.4	57.2
Southport	6.2	93.6	51.0
Westport	4.3	97.9	46.7
Norwalk	3.3	101.2	43.4
Darian	4.2	105.4	39.2
Stamford	4.5	109.9	34.7
Greenwich	5.1	115.0	29.6
Port Chester	3.1	118.1	26.5
Rye	1.7	119.8	24.8
Mamaroneck	3.7	123.5	21.1
New Rochelle.....	3.4	126.9	17.7
New York.....	17.7	144.6	0.0

HAYNES RUNS 300,000 MILES.

Early returns in the "old car" contest being conducted by the Haynes Automobile Company, which is intended to discover the oldest Haynes car still being operated in the United States, reveal one four-cylinder machine that left the factory in 1909 and since then has accumulated a mileage record of 300,000 miles in pleasure and passenger service. This record is supreme at this time. Among the other cars recorded there is a comparatively large number of two and four-cylinder cars that have averaged in the neighborhood of 100,000 miles each, and in many cases a large share of this mileage represents slow going delivery and trucking work. In commenting upon the returns, A. G. Seiberling, general manager of the Haynes company, said that they "serve to indicate that a well constructed automobile will run indefinitely with only a reasonable amount of care."

TIRE COMPANY AFTER THIEVES.

As a part of its service to users, the Pennsylvania Rubber Company has organized a theft recovery service to aid users in getting back stolen tires and stolen cars. A record of the purchasers of tires is kept and buyers are asked to report sales made later to enable the company to detect thefts.

COMING EVENTS IN MOTORDOM.

May.

Convention, Pacific Coast Auxiliary of National Association of Automobile Jobbers, Del Monte.....May 26-27
Race (speedway), Tacoma, Wash. May 30
Race (speedway), Indianapolis...May 30
Race (speedway), Minneapolis...May 30
Race (speedway), Des Moines....May 30
Race (track), Elmira, N. Y.....May 30

June.

American Liberty Day Committee, New York, Sheepshead Bay SpeedwayJune 4
Race (speedway), Chicago, International 300-mile contest.....June 10
Cruise, Society of Automobile Engineers, leaves Detroit 2 p. m. June 12-16
Convention for formation of Indiana Automobile Trade Association, auspices of National Association, IndianapolisJune 15-16
Race (track), Galesburg, Ill....June 20
Reliability run, Chicago Automobile Club and others.....June 23-24
Race (speedway), Des Moines June 26-28

July.

Convention, World's Salesmanship Congress, DetroitJuly 2-6
Race (speedway), Minneapolis...July 4
Race (speedway), Sioux City, Ia...July 4
Race (speedway), Tacoma.....July 4
Race (speedway), Coeur D'Alene July 4
Race (road), Visalia, Cal.....July 4
Race (track), Elmira, N. Y.....July 4
Race (track), North Yakima, Wash.July 15
Race (track), Omaha, Neb.....July 15
Demonstration (farm tractors), Dallas, Tex.....July 17-21
Demonstration (farm tractors), Hutchinson, Kan.....July 24-28
Demonstration (farm tractors), St. Louis, Mo.....July 31-Aug. 4

August.

Race (track), Tacoma, Wash....Aug. 5
Demonstration (farm tractors), Fremont, Neb.....Aug. 7-11
Race (track), Kalamazoo.....Aug. 11-12
Hill Climb, Pikes Peak.....Aug. 11-12
Race (track), Portland, Ore.....Aug. 12
Demonstration (farm tractors), Cedar Rapids, Ia.....Aug. 14-18

Race (road), Elgin, Ill.....Aug. 18-19
Demonstration (farm tractors), Bloomington, Ill.....Aug. 21-25
Race (track), Kalamazoo.....Aug. 26

September.

Show, Columbus, O.....Sept. 2-9
Race (track), Elmira, N. Y.....Sept. 4
Race (speedway), Des Moines...Sept. 4
Race (speedway), Indianapolis...Sept. 4
Race (track), Spokane, Wash..Sept. 4-5
Demonstration (farm tractors), Madison, Wis.....Sept. 4-8
Show, Milwaukee.....Sept. 11-16
Race (speedway), Providence...Sept. 16
Race (track), Trenton, N. J....Sept. 29
Race (speedway), New York, Sheepshead Bay Speedway.....Sept. 30

October.

Convention, National Association Automobile Accessory Jobbers, St. Louis.....Oct. 2-5
Race (speedway), Omaha, Neb..Oct. 7
Race (speedway), Philadelphia...Oct. 7
Race (speedway), Chicago.....Oct. 14
Race (speedway), Indianapolis...Oct. 19
Race (track), Kalamazoo, Mich..Oct. 21

KING MAKES HIGH GEAR RECORD.

An eight-cylinder King car recently was subjected to what is declared to be the most gruelling high-gear test to which a motor car has ever been put, by running from Los Angeles to San Francisco, over the exceedingly difficult coast route. Before the start the shifting lever was removed and the gears locked in high and sealed. While at certain seasons of the year the route is in fairly good shape for touring, at the time the King car was sent over it the several steep grades and mountain passes were in exceedingly dangerous condition, which makes the feat even more remarkable. After arrival in San Francisco and inspection of the seals by the secretary of state of California, the car was driven back to Los Angeles with the high gear still in use. The car was a stock machine throughout, and was driven by A. G. Woodill, who was accompanied by F. C. Jordan, Jr., of the Automobile Club of Southern California, as observer.



Anita King, Film Star and Owner of an Eight-Cylinder King Car, Welcoming Jerry Woodill at the Finish of His Record High Gear Run.

INDUSTRIAL NOTES AND COMMENT.

Recent Happenings Among the Makers of Cars and Equipment and Members of Related Industries.

The Willys-Overland Company announces the completion of another huge factory unit at its Toledo plant, the new building, which is known as No. 49 and is five stories high, giving 500,000 square feet of floor space additional for immediate use. The entire structure will be given over to the manufacture of closed cars, a type that owners are now demanding in larger measure for all-season driving. In this building, on the top floor, where the top and trimming departments are to be located, will be the only women employees now on the Overland pay roll, excepting those in the administrative offices. They will number about 800.

Metz Worcester Branch.

The new home for the Metz Automobile Company's, Worcester, Mass., branch on Main street is expected to be ready for occupancy about June 15. The building is two stories high and 60 feet square. On the first floor will be the salesroom, which Manager William Jones claims will be the most elaborate in the city. On the second floor will be the service station, access to which will be by elevator.

Allen Shortens Working Day.

The Allen Motor Company, Fostoria, O., has announced the inauguration of the eight-hour working day in its Bucyrus plant, the workmen to receive the same rate of wages for eight hours work as they did formerly for 10 hours. This plant has been working day and night for some time in the vain endeavor to catch up with the demand for Allen cars.

Westcott in Springfield.

The Westcott Motor Car Company will within the next few months remove its plant from Richmond, Ind., where it has

been located for a considerable period to Springfield, O., taking over the buildings formerly occupied by the Buckeye division of the American Seeding Machine Company. This plant comprises 14 acres of ground and a group of buildings that are thoroughly modern in every manufacturing aspect. It has about 175,000 square feet of floor space and valuable waterpower rights. The primary reason for the removal is ascribed to the fact that Westcott business had outgrown the facilities of the plant at Richmond. The Davis Motor Car Company is to occupy the old Westcott location, probably about the first of July.

Record Studebaker Shipments.

The present quarter of the Studebaker Corporation's fiscal year is showing even greater shipments than were reported for the same period immediately preceding. Sales of cars for the first quarter of the current year, ended March 31, were 16,952, as compared with 9400 for the same months a year ago, which shows an increase of 75 per cent. The completion of the new \$1,000,000 factory extensions will prove a considerable factor in enabling Studebaker to increase the output for the present quarter and the easing up of the freight situation will permit of shipping all the cars that can be built. With the largest selling organization in its history, numbering 5700 dealers, the problem of distributing this year's record output will be much simplified.

Burd Moves Detroit Office.

The Burd High Compression Ring Company, Rockford, Ill., announces the removal of its Detroit branch from the David Whitney building to a ground floor location at 578 Woodward avenue, De-

troit. Walter C. Willard is manager of the branch.

Jeffery to Build.

As a result of the tripling of the demand for Jeffery motor cars and trucks, the Thomas B. Jeffery Company will add two big, ultra-modern shop buildings to its plant at Kenosha, Wis. One of these will be a one-story foundry, 125 by 600 feet. In this factory unit, which is provided with every facility obtainable for the welfare of the employees and the production of Jeffery car parts, gray iron, aluminum and bronze castings will be produced. The other addition will be a five-story concrete structure, devoted entirely to the manufacture of car bodies, and will contain the most modern kilns for seasoning lumber. The Jeffery company now has 3100 men on its pay roll and the plant at present occupies 101 acres of ground, 26 of which are under roof.

Oldsmobile Teaches Service.

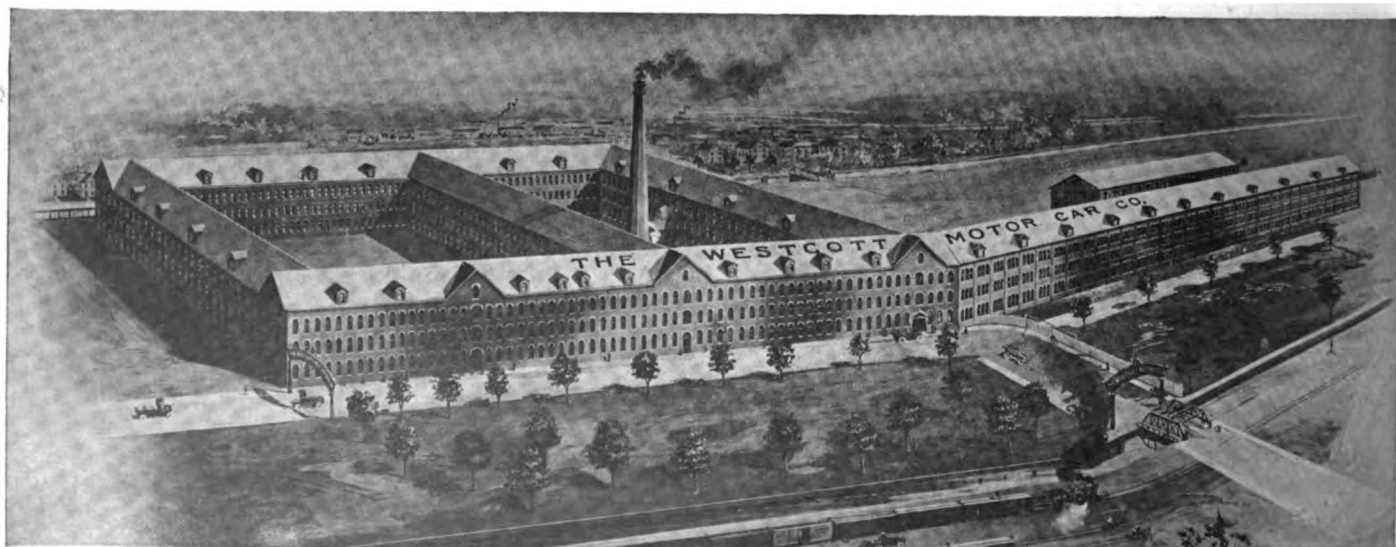
The Olds Motor Works, Lansing, Mich., has established at its plant a school for Oldsmobile service men at which they are taught standard methods of finding and correcting troubles and how to do this work in the least possible time consistent with good results. The school is open to Oldsmobile repair men and service men in all parts of the country, and at the first meeting held recently more than 200 were present.

Packard Employees Promoted.

As a result of their study in the Packard Motor Car Company's night school a large number of the employees in the Detroit plant have been promoted to positions in the engineering department. A class of 80 recently completed the prescribed course in mathematics and mechanical drawing and have received certificates. The entire enrollment is more than 150. The school is open to any employee of the Packard company and is presided over by five teachers.

Springfield Body Expands.

The Springfield Metal Body Company, Springfield, Mass., is to erect in Detroit, Mich., what is said to be the largest au-



The New Home of the Westcott Motor Car Company, Richmond, Ind., Which the Company Will Occupy About July 1—This Plant, Formerly Occupied by the Buckeye Division of the American Seeding Machine Company, Affords the Westcott Company Facilities to Double Its Production of Cars.

tomobile body manufacturing plant in the world. W. L. Fry, president of the company, announced that according to present plans the main building will contain about 500,000 square feet of floor space, more than 10 acres, and will be nearly a quarter of a mile long. At first 2000 men will be employed, this force being greatly increased at a later date.

BOSTON DEALERS TO PARADE.

One feature of the preparedness parade to be held in Boston, May 27, that will appeal to motorists, is that one of the principal divisions of the procession will be made up entirely of members of the Boston Automobile Dealers' Association. The directors of the association voted recently to take part and they expect about 2000 of Boston's most prominent automobile men to participate. The chief marshal of the division will be F. A. Hinchcliffe. J. H. Johnson is the chairman of the committee in charge. The other members of the committee are Joseph S. Donovan, L. B. Sanders, Harry Fosdick and Ralph B. Nettleton.

WOMEN TO BEAUTIFY ROAD.

Women of northern Georgia, representing the counties crossed by the Dixie highway between Chattanooga and Atlanta, are to hold a convention under the auspices of the Cherokee club. It will be devoted to considering ways and means of beautifying the eastern and western divisions of the highway. Congressman Gordon Lee of the Chicamauga district has given his aid by supplying 12,000 packages of flower seed. Mrs. O. T. Peebles, Mrs. Logan Pitts, Mrs. Z. I. Fitzpatrick and Mrs. Orrin W. Massey are among the prominent Georgia women who will attend the convention.

KING'S POWER DIAGRAM.

A diagram that shows the even and continuous flow of power to the rear wheels of an eight-cylinder automobile in comparison to the power impulses of the four and the six-cylinder motors, has been worked out by I. D. Rocap, technical engineer of the King Motor Car Company, Detroit, Mich. It has been copyrighted through the suggestion of Artemas Ward, Jr., president of the company, and is being distributed without cost to applicants by the King company.

BAY STATE ANNUAL RUN.

The annual run and outing of the Bay State Automobile Association will be held June 16, 17 and 18 at Spofford Lake, N. H. Pine Grove Hotel has been engaged exclusively for the club and there will be ample accommodations for all members and their guests, among whom will be several from the Worcester and Springfield automobile associations. It is expected there will be about 100 machines on the run this year.

NEW TYPE OF KEROSENE ENGINE.

An Exceedingly Compact Kerosene Burning Motor Weighing Only About 200 Pounds Complete.

The Field Motor Company, Grand Rapids, Mich., recently organized with a capital stock of \$100,000, has commenced manufacture of a kerosene burning engine of a design different from any which has yet appeared on the market. It is of the four-cylinder, four-cycle type, having the cylinders directly opposed.

The cardinal feature of the motor is its compactness, which is one of the chief results of this unusual construction. The complete engine occupies a space of only 11 by 23 by 14 inches and weighs but 200 pounds. A feature of great interest is that the pistons in opposite cylinders are coupled with tie rods, and operated on one crank with one connecting rod, which arrangement eliminates two cranks and two connecting rods with their bearings and piston pins. As the pistons and tie rods are made from one casting, the construction can be said to be practically a continuous piston. The tie rods connecting the pistons have a sliding fit on each side of the crank slabs and the top and bottom of each crankshaft bearing. This construction reduces vibration to the minimum and consequently permits great velocity.

The cylinders and crank case are cast integral and are equipped with removable cylinder covers and also top and bottom crank case covers, making inspection simple and easy for the operator. Perfect alignment of the cylinders is insured by their being bored with one boring bar. The ends are milled and squared at the same operation. The intake and exhaust manifolds are constructed in one casting of simple design. The surface is so proportioned that kerosene can be used through any standard carburetor without change of adjustment.

Any standard make of carburetor may be used with this engine. It is placed above the cylinders and the charges gravitate down to the manifold. The secret of handling the low-grade fuel is that the heat units of the exhaust heat the charge before entrance to the cylinders, thus insuring thorough and powerful combustion.

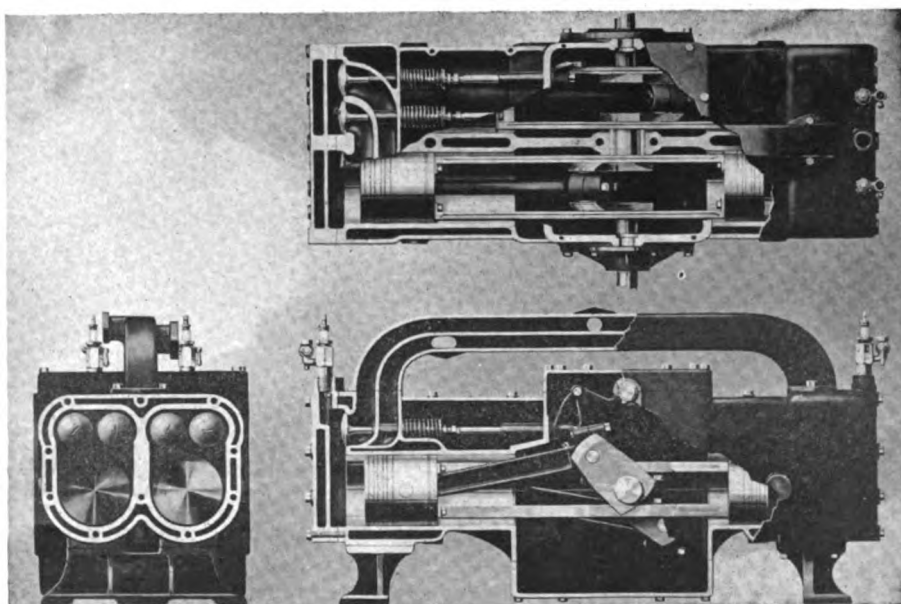
The motor is started with gasoline as a fuel and when a high temperature is reached, a change is made to kerosene by the use of a three-way valve and a slight advance of the spark.

The camshaft and magneto are operated by a set of inclosed spiral gears. If the engine is to be used for stationary purposes, an adaptable governor may be attached. This engine is designed for motor boats, tractors and trucks. The original models have been thoroughly tested, with gratifying success.

"OLD RELIABLE" STILL ON DECK.

"Old Reliable," the first Chalmers 30 turned out in 1909, which has now been driven more than 200,000 miles and has been a familiar figure on the streets of Detroit for many years past, is still in active service.

When this car was young it was driven 20,000 miles in a reliability run between Detroit and Pontiac. Later with Billy Knipper, the well known race driver, at the wheel it was the pathfinder for a tour from Montreal to Mexico City and the crew which accompanied it had some hair-raising experiences on the Mexican desert. It was the first car to cover the distance between Denver and the City of Mexico.

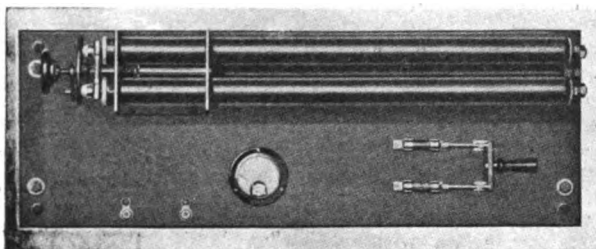


Three Section Views of the New Field Kerosene Burning Engine.

MOTOR STARTING AND CAR LIGHTING.

How the Efficiency of the Storage Battery May Be Reduced by Different Conditions and the Means for Restoration by Individual Care of the Cells.

STATEMENT was made in the preceding installment relative to the abnormal charging that was done by generator while the car is be-



Allen-Bradley Charging Panel, Completely Equipped with One Charging Rheostat.

ing driven, and the necessity of outside charging at frequent intervals to reduce the natural sulphation of the plates of the cells and to restore the battery to its normal efficiency. The continuation of a charge at low amperage after it has been charged is the only certain restoration, and if the charge is extended from four to six hours the condition of the plates will be much improved. Ordinarily such a charge should be given at intervals of about two weeks.

Recommendation was made that small charging apparatuses be used by the owner because of the economy, for the expense of such equipment is comparatively low, but the average owner may assume that because he is not familiar with the use of chargers that he will not be able to operate them successfully. There is no reason for such apprehension. In fact, the man who will follow the instructions will have a large measure of success.

The storage battery is not a mystery. It is scientifically designed and constructed and to sound engineering principles. Any man having a battery can obtain practical results if he will be guided by the advice of the manufacturer of it and the maker of the charging apparatus. Chemistry and electrical engineering are exact sciences and the principles and ratios and operating results involved have been carefully determined.

No owner, even should he be a battery expert, has any reason to vary from the means prescribed for charging and maintaining a battery. The batteries are carefully designed and are built for use to absolutely definite rule. The owner who imagines that he can improve the equipment

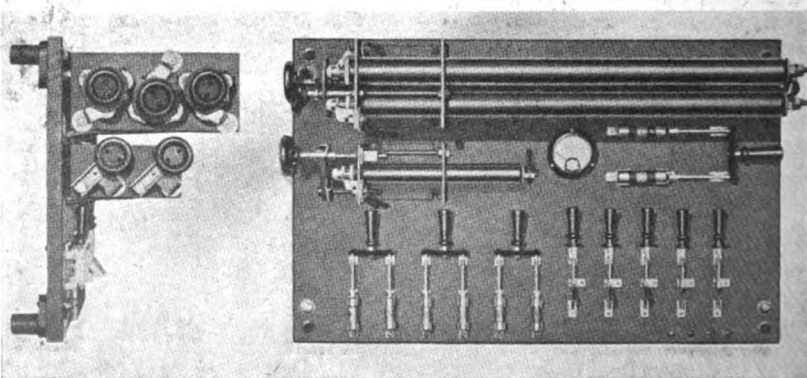
through experimentation, makes a serious error. The manufacturers maintain large engineering staffs and laboratory facilities to obtain the greatest economy and efficiency, and there is little probability that a man without electrical knowledge can improve the systems.

The average storage battery can be likened to a watch in general operation. So long as the watch is wound regularly and is kept clean and is not opened the probabilities are that it will be a satisfactory timepiece. The care is extremely simple, and the best attention is not "tinkering" with it. If irregular it can best be adjusted by an expert, a watchmaker who judges the condition from what is told him, who "regulates" its speed and after setting places it in the hands of the owner.

Careful Observation Necessary.

What is true of the watch is absolutely true of the storage battery. What is first required is careful observation of its activities. While the battery in the car will undoubtedly be charged irregularly, it can be "regulated" by the occasional long over-charges, but charging does not mean that the electrolyte should be replenished, because this would bring about conditions that would quickly destroy the cells. Neither should the owner assume that he understands batteries better than the engineer who designed it.

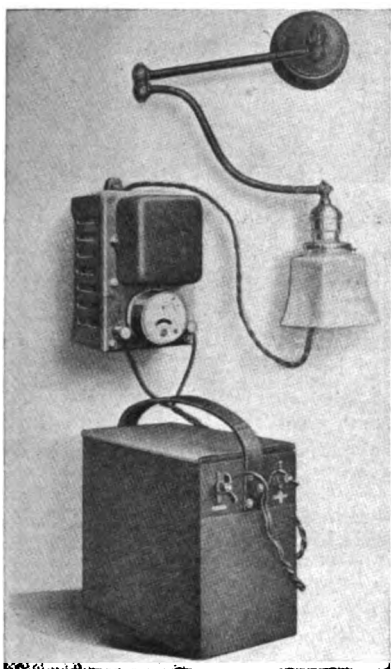
The average owner may keenly realize that he does not know much about batteries, but he will not hesitate to ask, and very often accept, the advice of a person who has absolutely no knowledge of them. This is about the most serious mistake that could be made. The battery manufacturer has prepared and furnishes with every battery very definite rules relative to their care



Allen-Bradley Charging Panel Completely Equipped with Three Charging and Two Discharging Rheostats.

and maintenance. These rules are what really concern the owner.

Very generally the instructions are forgotten



The Wagner Alternating Current Rectifier for Charging Batteries from an Electric Light Fixture.

because in sublime ignorance the owner relies upon his own judgment, and this, while it may be valuable with reference to other subjects, is worse than worthless. In fact, it is positively destructive. The best advice that can be given any owner is to carefully read and digest the rules supplied by the manufacturer. Next, the principal suggestions

should be studied and memorized. Beyond this a small record relative to conditions ought to be kept.

Of course, if the owner does not wish to give the attention advised, he must regard himself responsible for the consequences. The value of the record is much more than is usually realized. For instance, the specific gravity of the cells, taken at the end of the overcharge, and while the current is flowing, should be known. If the specific gravity of the cells is learned when they are examined for height of electrolyte, this will be a guide to their general condition.

Learn the Condition of the Cells.

For instance, this ought to indicate the condition with reference to charge, and should the gravity be found to be low, less than 1200, to illustrate, the battery ought to be removed from the car and given a complete charge. But better treatment would be to discharge the battery to a point where the specific gravity indicated 1160 or thereabouts, and then completely charged. Discharging can be done by burning the lamps without the engine running, making tests of the electrolyte as the gravity and voltage falls.

There are those who will advise running the car engine for battery charging. This is injudicious because the battery could not be charged as slowly as is desirable, and running the engine for the time required would cost more for fuel and lubricant, to say nothing of the wear of the mechanism, that would be charged for the same service at a charging station. Not only this, one would not care to have an engine run unattended, and so attention must be considered.

What the Examinations Will Show.

But the examination of the cells will deter-

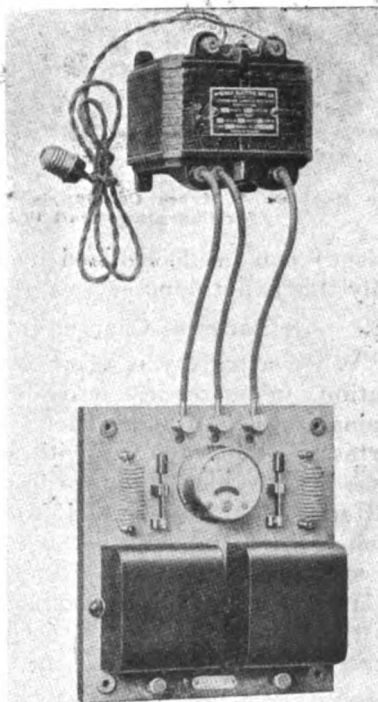
mine other conditions that are important to know. When a battery is well conditioned the cells should have approximately the same specific gravity. In the event that they vary considerably there is reason to assume other possibilities. Unless the battery has been in service for a considerable period there is little probability that there has been a sufficient accumulation of sediment in the bottoms of the cells, from the shedding of active material from the plates, to cause short circuits. But if the car has been used through a season this is a cause that may be possible.

Constant over-charging and continued gassing will cause particles of the positive or peroxide plates to be broken off and these will be precipitated to the bottoms of the cells. The plates rest on high ribs or "bridges" to keep them from contact with this sediment until after long periods of service. But the introduction of foreign matter into the cells with the water with which they are equalized (restored to the normal height of electrolyte) may have caused local action.

Damage from Local Action.

Metallic particles in the electrolyte may have become attached to the surfaces or some of the surfaces of the positive plates, and these will in turn become minute cells, each of which is constantly active, which will eventually cause holes to be eaten into the plates. This local action will, unless the cause is removed by cleaning the cell, gradually reduce the activity of the plates, and there will be lessened capacity.

The effect of the lessened voltage of a cell, and the voltage is the measure by which capacity is determined, is to reduce the other cells with which it is connected, although these may be in perfectly normal condition. The only manner in which the battery can be restored from this condition is to test all of the cells with care, remove and clean the defective cell, and then charge the restored cell until its capacity is practically uniform with the others.

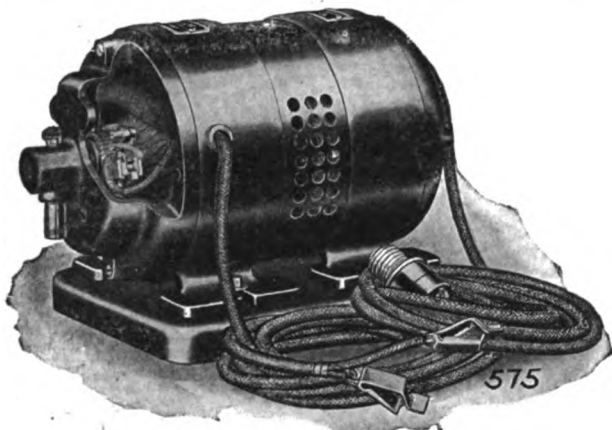


Wagner Double Vibrator Type Rectifier, Which Rectifies Both Halves of the Alternating Current Wave.

Two Forms of Tests Are Necessary.

The tests of the cells should always be made by both specific gravity and voltage. Either is reasonably reliable, but when they are used in combination there is very little probability of error, for the one is a check upon the other. The voltage of the battery increases as it is charged, and, as will always be noted on the instruction plate on the battery, the first part of the charge should be at higher amperage than the last part. That is to say, there are two rates, and usually the first is continued until the cells begin to gas, when the amperage is reduced to the finishing rate and continued to a point when the voltage no longer rises and the reading will continue without change for a period of at least a half hour.

The readings of the ammeter and the indications of specific gravity are the basis of judgment for determining the condition of the cells. But obviously to learn accurately the state of each cell it should be tested separately. Where skilled battery work is done the state of each plate with relation to each other and to a standard of ef-



The Robbins & Myers Company's Motor-Generator Set for Charging Small Batteries.

iciency can be determined by tests, but ordinarily this is not done.

Batteries Charged in Series.

When a battery is given over to a charging station, unless request is made for a careful examination, it is usually placed on charge and, so far as possible, in series with a group of batteries. For instance, it is best to charge 18 six-volt batteries in series from a 110-volt current rather than half that number, because all current in excess of the value required to give the necessary charge is lost in the rheostat, and as current costs money, there is a decided saving when charging a larger number up to the capacity of the line.

Because of this manner of charging the batteries come in for general rather than specific observation, unless there is some reason to give special attention. The readings are made from the switchboard with reference to voltage, and the test for specific gravity is made at the centre

cells if possible. With the ordinary hydrometer only the expert can make very accurate readings because of the comparatively minute scale, and considerable depends upon the experience of the battery man.

Some Reasons for Low Voltage.

When the battery does not show in specific gravity the voltage that ought to be expected, this is a reason that the cells should be examined. There are numerous reasons why a cell may not be up to the standard expected. A leaky cell, caused by a crack in the rubber jar, will show a reduction of electrolyte as compared with the others in the battery, and this will mean that some of the plate area is exposed, so that there is a lesser degree of activity. There is also a possibility that the plates may be so sulphated that the reduction is slower.

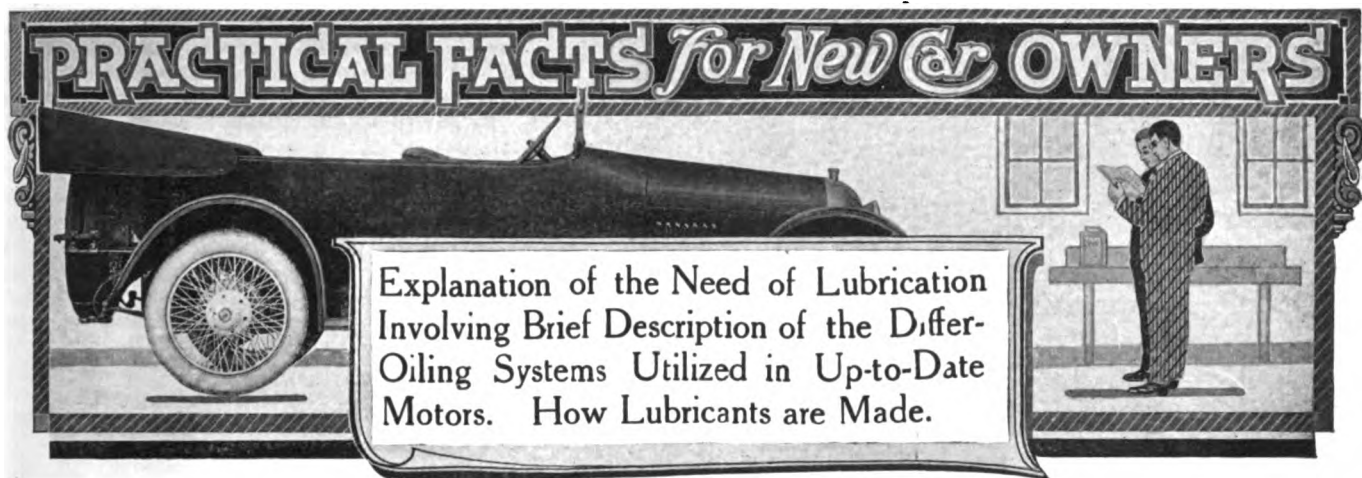
Assuming that a battery is to be fully charged. The specific gravity at the end of the charge ought to be 1285 at 85 degrees of temperature, but the full charge may be reached before this, because, due to loss of electrolyte from gassing and slopping, the gravity may be considerably lowered. When the specific gravity is 1250 and the voltage will not rise with continuation of the charging, this is a certain indication of reduced electrolyte that can only be restored by the addition of a new solution.

Charge the Low Cells Separately.

But in the event that the specific gravity of one or more of the cells be low this does not necessarily mean new electrolyte. The low cells should be charged separately at low rate. Should the gravity increase with individual charging this is an evidence that the cell had been run down and simply required additional charging. But if the gravity does not rise when charged separately and the temperature does not increase very rapidly with the charge, one can assume that the gravity has been lowered by the addition of water that has been added to fill the cells to the standard height.

If the loss has been due to stoppage the gravity should be restored by the addition of electrolyte. New electrolyte can be obtained from the makers of the batteries or their service stations, but it can be made by mixing chemically pure sulphuric acid, which is 1842 specific gravity, with $4\frac{3}{4}$ parts of water, which will give a solution of a density of 1200, or one part of acid and three parts of water will give 1275 specific gravity. When the acid is mixed it should be poured slowly into the water and thoroughly stirred with a wooden paddle. The determination of the value of the solution must be made when it has thoroughly cooled, for the electrolyte will heat while it is being mixed. Only a glass or an earthen dish should be used for preparing the solution.

(To Be Continued.)



Friction is a force that has a tendency to retard motion, and since the automobile engine is composed of rapidly moving mechanism, it will be readily realized that lubrication is one of the chief factors to be considered in its maintenance. Another reason why it is imperative to afford ample lubrication for the motor is that heat stimulates molecular movement and thus increases the friction between any two metals in contact.

Lubricants are classified as fluids, semi-solids and solids, and these are either of animal, mineral or vegetable origin. For the automobile, oils and greases obtained from a mineral source are almost exclusively used, although racers generally use castor oil, which is of vegetable origin, in their motors. The two requisites for a good cylinder oil are that it must have a high flash point and also retain its consistency at high temperatures. It must also be free from impurities, as acids quickly attack the metal surfaces.

One often sees a statement made by an oil refiner that a particular oil has a certain flash point, viscosity, fire and cold test. These are important factors to be considered and should be inquired into before purchasing an oil.

The flash point is the temperature at which, if an oil be heated and a naked flame be held above it, the rising vapor will catch fire, but not continue to burn. This point is determined by placing a thermometer in the oil and then heating the latter until the vapor catches fire. The exact temperature indicated by the thermometer shows the flash point.

Viscosity is the property of a fluid by which it has a tendency to resist flowing. There are several methods of testing for this property in an oil; a simple method is to place a few drops of different grades on a smooth inclined surface. The oil which flows the fastest is said to have the least viscosity.

The fire test of an oil is found by merely extending the flash point test. It is the point where the vapor rising off the heated oil will continue to burn and

not merely flash up and then die out.

The cold test is conducted to determine the temperature at which the oil becomes so thickened that it will not flow.

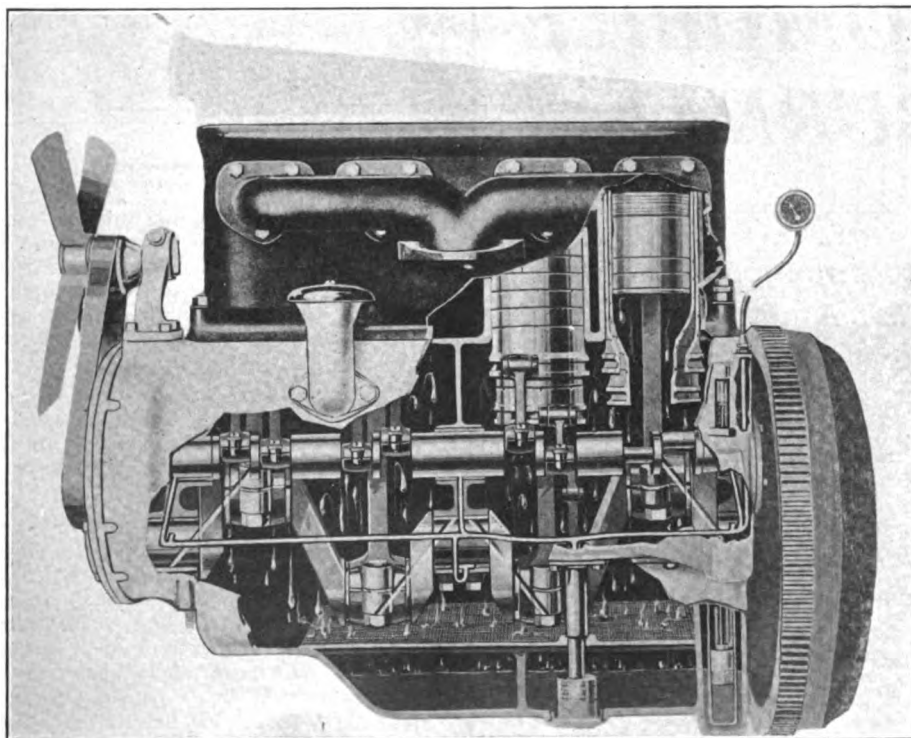
Because of the extreme changes in temperature to which the average motor is subjected, it is plain why the points described above must be taken into consideration when selecting lubricating oils. The car manufacturer usually advises the use of a particular oil for the motor, and it is always good policy to follow this advice and not to experiment with other lubricants. However, there are at least 12 reliable oils on the market and when a particular kind cannot be obtained it will no doubt be safe to substitute any of these.

No space need be allotted for reference to the components of an automobile that require lubrication. It should be remembered that all moving parts are made with a high degree of accuracy and to maintain this condition it is imperative that at all times there be an ample supply of the proper lubricant. Chassis lubrication is comparatively simple and readily understood by everyone. There are several engine lubricating systems, however, and these may be classified as the splash, splash with circulating pump, full forced feed and mixing the oil with the gasoline.

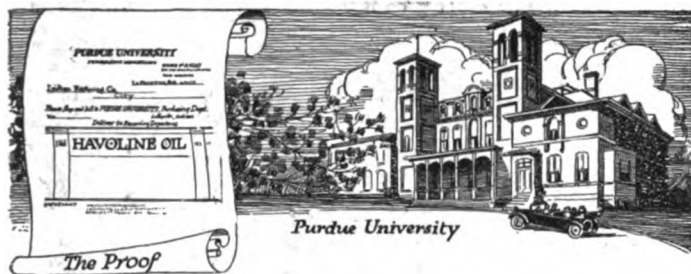
Let us first consider the splash system, which is the simplest in operation. The Ford engine uses this system. The manufacturer recommends a light high-grade gas engine oil for the model T motor. This grade is advised because it will

naturally reach the bearing surfaces with the greatest degree of ease. The lubricant is poured directly into the crank case until the level is above the lower oil cock. There is also another oil cock which indicates the high level. The correct level is obtained when it reaches a point between the two. It should never be allowed to fall lower than the first mentioned cock and never higher than the upper cock.

The principle of circulation is as follows: The fly-wheel operating in the oil splashes some of the lubricant up so that a part is caught in a tube and carried to the front end of the



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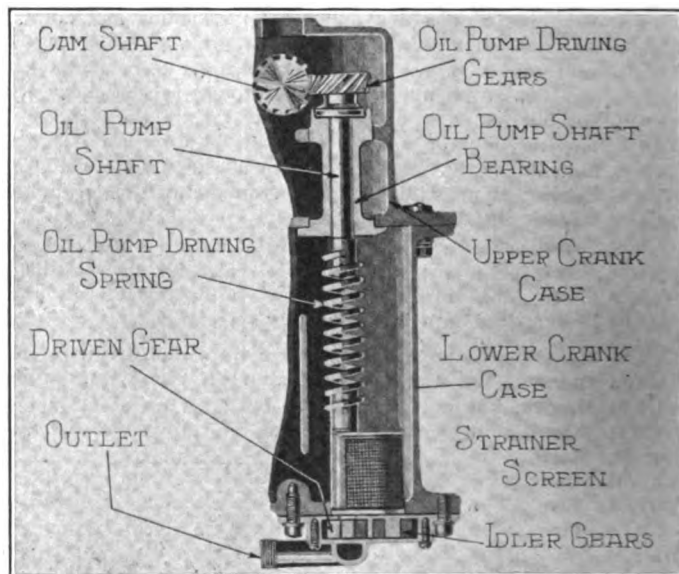
(When Writing to Advertisers, Please Mention The Automobile Journal.)

crank case to lubricate the timing gears. The oil then has a tendency to travel back to the rear of the crank case and in this manner tends to keep small reservoirs filled under each connecting rod. Attached to the end of each connecting rod is a small scoop, which picks up the oil and throws it up into the cylinder, thus affording lubricant for the cylinder walls, piston and bearings.

Splash with Circulating Pump.

The Buick 1916 models use the splash with circulating pump system. There is a reservoir in the lower half of the crank case from which oil is sucked through a strainer into a pump housed at the rear end of the reservoir. The pump then forces the lubricant through a pipe to a sight feed on the dash, where the circulation can be observed by the driver. From here the oil returns through the distributor pipe to the splash trays or troughs, cast in the lower half of the crank case. As the connecting rod dippers pass through the oil in these trays, they force some of it up into the connecting rod bearings and splash the remainder over the interior of the crank case and up into the pistons and cylinders. As the lubricant drains back it is caught in ducts and led to all the bearings of the motor, the excess running back in the main reservoir, or sump, to be used again.

The oil circulating pump consists of two small gears enclosed in a close fitting housing attached to the lower half of the crank case and driven by a vertical shaft and spiral gears from the cam shaft. As the gears turn, they take the oil into the spaces between their teeth and carry it around to the



Type of Oil Pump Incorporated in Splash with Circulating Pump System Used in the 1916 Buick Models.

outlet, where the action of the teeth meshing together squeezes the oil out of the spaces and forces it to flow to the sight feed on the dash. The operation of the pump is entirely automatic, and requires no adjustment or attention, except for the addition of fresh oil to the crank case reservoir as often as necessary to maintain the level up to the pet cock.

The pump can at any time be easily removed by first draining all oil from the crank case and then removing the four large screws which hold it. It can then be taken out from below, the squared end of the shaft pulling out of the gear.

Full Forced Feed System.

In the Willys-Knight motor the oil is circulated by an oscillating pump located back of the centre rib of the cylinder block. The plunger of the pump is connected to and operated by the eccentric shaft. The lubricant is drawn from the oil base through a fine mesh screen and forced direct to the three main bearings. From these the oil is forced through holes in the crank shaft to the connecting rod bearings. The oil is also led to the bearings of the eccentric shaft, and from the front main bearing to the chains and sprockets which replace the timing gears of ordinary types of motors.

The design is such that the oil works out around the bearings and the speed with which the parts are moving throws the oil in a fine spray to the sliding sleeves, which are used instead of valves, to the bearings of the wrist pins and sleeve connecting rods. The oil then drips back to the reservoir through a perforated screen.

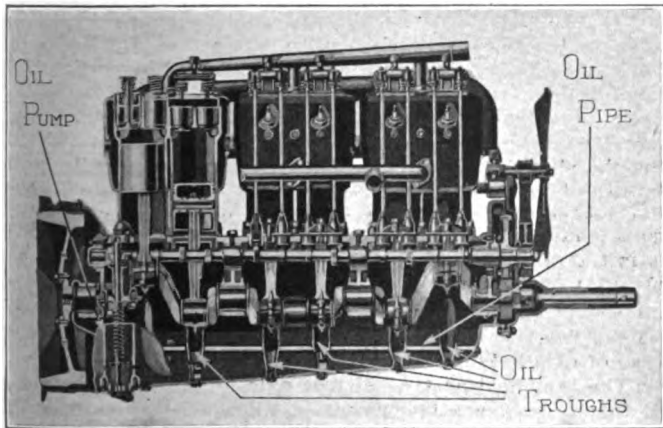
An interesting feature of the system is that the flow of oil is regulated automatically with the gasoline by a valve just in front of the oil pump and which is connected to the throttle lever. Opening the throttle opens the oil valve so that as the motor speed increases a greater amount of lubricant is fed to the bearings.

It is imperative that the oil strainer be kept clean so that the circulation of the lubricant is insured. The removal of the strainer is made easy by unscrewing the plate on the bottom of the oil pump. This also provides a means for draining the lubricant from the reservoir. The manufacturer suggests that this be done once every 1000 miles. The oil pan, or reservoir, should then be washed out by pouring kerosene into the breather pipe. After removing the kerosene, replace the plate and refill the system by using the old lubricant, being careful to strain it through a fine grade of muslin. Add fresh lubricant to make up the proper amount.

The proper working of the system is indicated by a pressure gauge located on the dash. It is not necessary that this gauge indicate a given amount of pressure in pounds, it being sufficient to notice the slightest detection of pressure by the needle moving to the right when the motor is accelerated.

Mixing Oil with Gasoline.

Mixing lubricating oil with the gasoline is a system used almost exclusively in two-stroke cycle engines. The propor-



Sectional View of the Buick Motor Showing the Arrangement of the Lubricating System.

tions used vary but one pint of lubricating oil to five gallons of gasoline is not a bad minimum. The principle involved is that a mixture of gasoline and oil is drawn through the carburetor. The gasoline is transformed into a vapor, but the oil remains in its original condition and is carried in small globules along with the mixture of gasoline and air into the crank case. Part of it then settles on the connecting rod and crankshaft. On the downward stroke of the piston the remaining oil and the gas are forced through the by-pass into the cylinder, thus affording lubrication to the cylinder walls.

CLEANING THE HANDS.

It is impossible to keep the hands clean when making repairs on the machine. A simple and economical way in which to cleanse them is as follows: Mix a small quantity of sawdust and lubricating oil together and rub thoroughly into the pores of the skin. The oil should then be removed by wiping the hands with a cloth which has been saturated with a little gasoline or kerosene. This should be followed by the ordinary wash with soap and water. It is poor practise to attempt to remove the dirt from the hands by bathing them in gasoline, as this will cause some of the matter to become deeply imbedded in the skin.



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REAR AXLE TYPES EXPLAINED.

(F. J. Y., Oldtown, Me.)

Having subscribed to your magazine at the recent Boston show, I would like to have explained to me as plainly as possible, the following terms which are applied to rear axles: Floating, three-quarter floating, semi-floating, live and dead axles.

Rear axles are classified into two types, dead and live. The former is the simpler, it being practically the same as used on horse drawn conveyances. Both rear wheels are independent and revolve on a stationary axle. The wheels are driven by chains from sprockets mounted on the countershaft. The differential assembly is also mounted on the countershaft.

The term live axles denotes that the wheels are connected in some manner with revolving shafts. These shafts propel the wheels.

Live axles are said to be either floating, three-quarter floating or semi-floating. The floating axle is as the term implies, one which floats. It serves no other purpose than to propel the wheels. Absolutely no weight is carried on the shafts, and they could be removed and it would still be possible to tow the car. The entire weight is carried by the housing, as shown at A in the accompanying illustration. The inner ends of the axle shafts are grooved and fit into corresponding grooves in the differential gears. Either drive shaft may be removed by merely taking off the hub caps and sliding the shafts out. The end of the shafts are usually keyed into the hub caps. Some forms have a toothed clutch, which fits into corresponding recesses in the outer face of the hub. This construction permits flexibility.

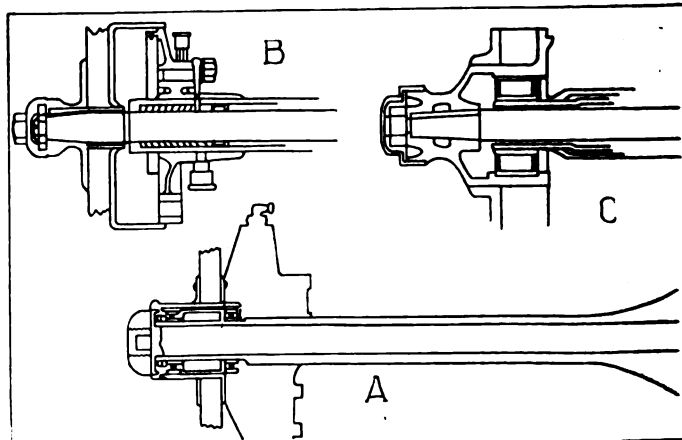
With the three-quarter type of axle the weight is carried by the housing. Although the axle shafts are relieved from all weight, the wheels are keyed to the end of the shafts. Should this type of axle break, the wheel would fall off. This type of axle is illustrated at C.

The semi-floating type of rear axle differs from the above in that it performs two purposes. Besides transmitting the power to the wheels, it bears the entire weight of the rear of the car. The wheels are keyed directly to the end of the shafts and the weight is carried by bearings at the wheel and differential ends. The semi-floating type is shown at B.

WANTS TO KNOW THE MEANING OF HORSEPOWER.

(B. H., Philadelphia, Penn.)

Will you describe as simply as possible the real meaning



Three Types of Rear Axles Now in Vogue in Pleasure Cars—A, Full Floating; B, Semi-Floating; C, Three-Quarter Floating.

of horsepower? How is horsepower computed in this country?

Before engines were invented horses were largely used to furnish power for the operation of machinery. It was, therefore, quite natural that the power of an engine should be determined by comparing it to the number of horses required to equal its power. A series of tests brought out the fact that the average horse was capable of delivering continuously, over a period of several hours, the power equivalent to lift 33,000 pounds one foot in every minute. For the reason stated, this has always been considered the standard unit of horsepower.

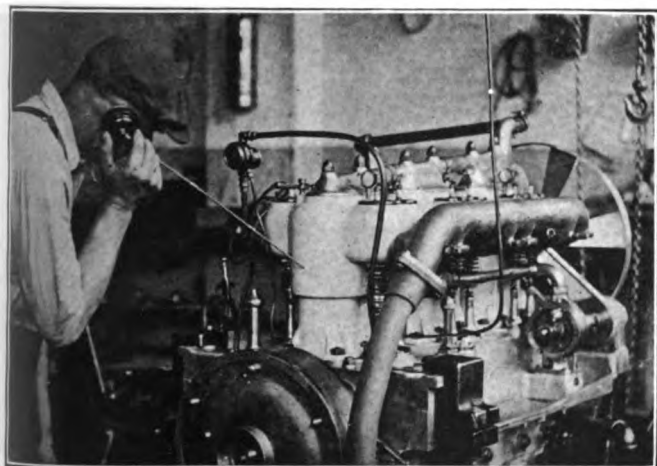
The S. A. E. formula is adopted as standard in this country for determining the horsepower of a motor. It does not take into the consideration the stroke and is found by multiplying the bore in inches by itself and then multiplying by the number of cylinders. This product is then divided by the constant 2.5.

TESTING THE MOTOR FOR KNOCKS.

(A. J. P., Crompton, R. I.)

How do the manufacturers of motor cars test their motors for noise, and how can they produce engines that can scarcely be heard in operation when new? By this I mean the method used for locating very slight motor knocks.

Practice differs among the manufacturers, but the accompanying illustration shows how one Detroit maker conducts the test, which is a method that is much used in the industry. The instrument shown is a stethoscope, which is simi-



A Large Motor Manufacturer Utilises a Stethoscope to Detect the Source of Slight Motor Irregularities.

lar to that which the physician uses to test the heart action of a human being.

While there is a marked similarity in the purpose of the manufacturer's and the doctor's instruments, the one used for mechanical purposes is slightly different in general appearance. It consists of a steel rod made in three sections and combined with a regulation telephone receiver. By placing the end of the rod against the motor casting the source of trouble is easily located, even though the noise be exceedingly slight. These tests are generally conducted in "silence rooms," that is, apartments which have sound proof walls and floors, which prevent outside noises from penetrating. In these rooms and with the aid of the stethoscope even the lightest of valve slaps or other engine knocks can be quickly detected and located. Road testers also use similar instruments.

WANTS INFORMATION ON KING CAR.

(T. G. H., Providence, R. I.)

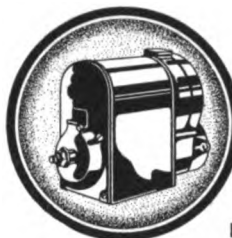
Can you inform me as to the size of the valves used in the King eight? Is it true that this car has a record for traveling through mountains on high gear. If so, what is the record and Where was it made? Where is the tire pump located on this car?

In the new eight-cylinder King car the valves are unusually large, having $1\frac{1}{2}$ inches clear opening, which is about one-half the size of the cylinder bore.

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The five-passenger, eight-cylinder King lays claim to having made a 1700-mile trip on high gear through the mountains of California.

The power tire pump is located on the transmission case under the floor, and is operated by a lever which projects through the floor board.

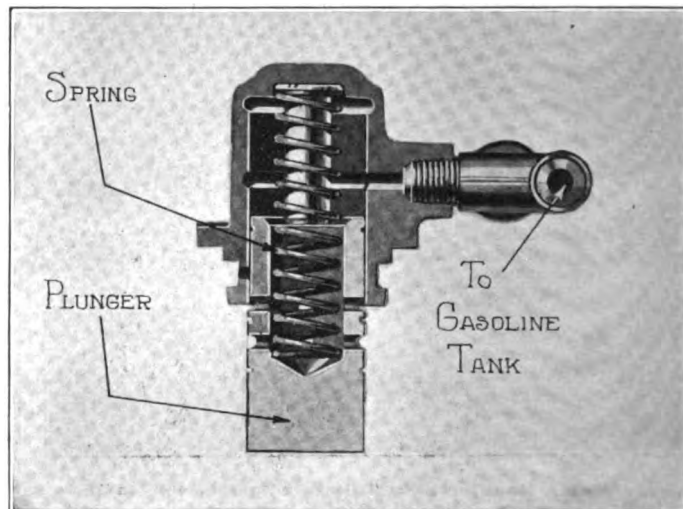
PRESSURE PUMP ON CHALMERS 18.

(R. F., Newark, N. J.)

I recently purchased a second hand Chalmers six-cylinder, model 18, from a New York dealer. He informs me that the gasoline is forced out of the tank under the seat by air pressure, but could not make it clear to me exactly how this is done. If you have any data on this particular car and can make the principle clear, I will consider that you have done a great favor for one of your old readers.

You can better understand the principle involved by referring to the sectional diagram of the pressure pump shown herewith. The pump is attached to the forward end of the crankcase on the left side. It is a simple two-cycle plunger pump and is operated by an eccentric on the camshaft. As the camshaft revolves a spiral spring forces down a plunger. This creates a vacuum in the pump, which is filled by air rushing in through a port. The continued revolution of the camshaft then drives out the air through two other ports and into the gasoline tank.

The manufacturer states that this pump is so constructed that only two pounds pressure of air can be forced into the



Sectional Diagram of Pressure Pump Used in Chalmers Car to Force Gasoline Out of Storage Tank.

gasoline tank. This insures sufficient pressure to give an even supply of fuel, but at no time enough to place an undue strain on the tank.

ADVANTAGE OF MUFFLER CUT OUT.

(F. D. K., East Aurora, N. Y.)

There is much discussion here concerning the use of the muffler cut out. Some claim that its use affords greater power, while others claim that the engine does not heat as much. Your opinion on this subject would be much appreciated.

Actual tests have demonstrated that in late models of pleasure cars the muffler cut out affords no particular advantage to the operation of the motor. In the earlier designed cars the cut out could be used to advantage because the mufflers were so designed that the exhaust gases could only pass through with difficulty and at normal engine speed there was a tendency for the gases to crowd each other. This condition is known as back pressure and it taxes the power of the motor. Muffler manufacturers have overcome this fault, their present day products being capable of handling the maximum volume of exhaust gases.

Racing cars are never fitted with mufflers because they use engines which are capable of a great many more revolutions per minute than are pleasure car motors. It is obvious that due to the rapidity of explosions, there is a larger volume of exhaust gas to expel and if a muffler was used there

would no doubt be back pressure. The only reason for fitting the muffler to the pleasure car is to silence the motor explosions. Noise is a minor consideration when racing.

It is essential that the muffler be given a thorough cleaning at regular intervals, as soot is apt to clog the narrow chambers. This condition would, of course, result in back pressure and is, no doubt, the reason for many motorists believing that the cut out can be used to advantage with the improved muffler types.

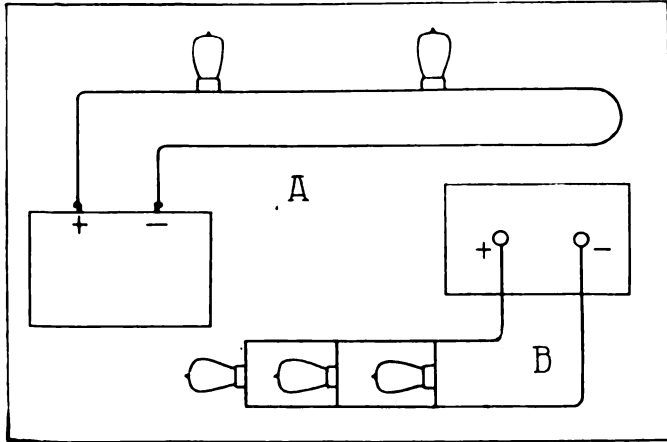
WIRING OF ELECTRIC LIGHTS.

(H. G. O., Olin, Ia.)

Please explain, and illustrate if possible, the difference between series and parallel wiring of electric lights.

The accompanying illustration shows the wiring diagram of electric bulbs, both series and parallel. The plan shown at A is the series wiring. It will be recalled that if electricity is to serve its purpose, it must have a complete circuit, that is, it must return to the original source. The disadvantage of series wiring is that should one lamp burn out, the other bulbs in that circuit will be rendered inoperative. The reason for this is that the current will not flow, due to the fact that it has no path for its return.

A plan of parallel or multiple wiring is shown at B. It will be noted that all the positive terminals of the bulbs are connected to each other, as is also the negative terminals. It is plain that this arrangement does not interfere with all the lamps, even though one or more of the lamps burn



A, Diagram Showing Electric Bulbs Wired in Series; B, Electric Bulbs Wired in Parallel or Multiple.

out, as a path is provided for the current to flow through the other filaments.

GEARS GRIND WHEN CHANGING SPEEDS.

(T. A., Elizabeth, N. J.)

Recently I had my six-cylinder — tuned up by a local repair man. He greatly improved the operation of the engine, but I have trouble when changing gears, and require much pressure on the lever to mesh them. This causes a loud grinding sound. I consulted the work man, but he declares that he did not disturb the transmission. What would you suggest as being the cause?

There are several probable causes for this condition. If this trouble has been coming on gradually, it is an indication that the gear shaft bearings are worn, thus causing the shafts to be badly out of alignment. The remedy is, of course, to fit new bearings.

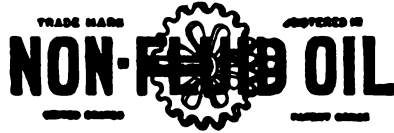
On the other hand, if the trouble has been evident only since receiving the car from the repair man, and as he declares that he has not touched the transmission, it may be that he overhauled the clutch and did not adjust it properly when assembling. The trouble may be that when the clutch pedal is fully depressed, the clutch has a tendency to drag and, therefore, continues to revolve with the engine. For quiet gear changing it is imperative that when the clutch is disengaged, it must be absolutely free of the engine. Lift out the floor boards, depress the pedal and note whether the clutch continues to rotate or gradually comes to a stop.

Trouble such as you refer to should be investigated at once, as nothing will cause so rapid wear of the gears as improper meshing.

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Greasy Brakes are Dangerous!

Beware of common grease which melts and flows onto the brake band lining lessening the gripping power of brakes. Get a lubricant that won't do this.



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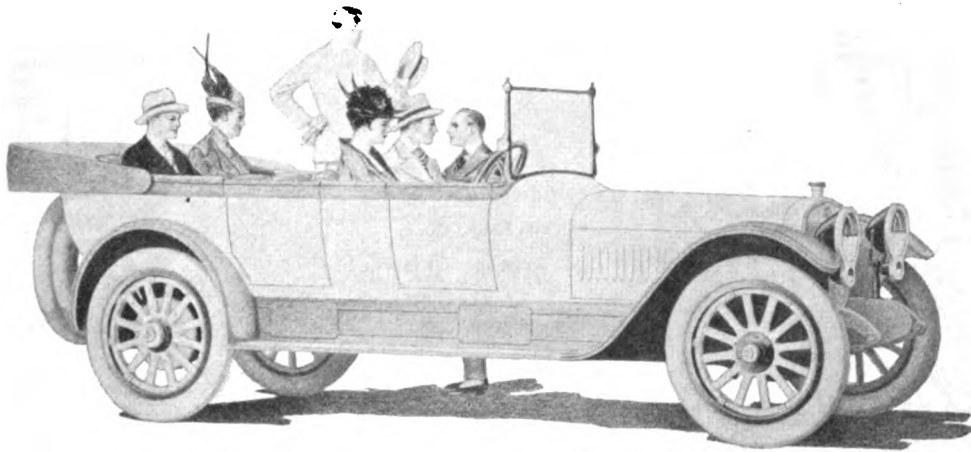
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are unequalled for motor lubrication, freer from carbon, economical because they protect the motor against mechanical wear, and the quantity required is comparatively small.

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MICHELIN

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Michelin Universal Treads and Red Tubes**

The Michelin Universal Tread Casing, the latest product of the house that made the first pneumatic tire, combines all the advantages of non-skids of both the saucer-tread and section-tread types.

This casing weighs from 12 to 15% more than the average because of its Extra Rubber and Fabric, and this means extra mileage.

A Word About Tubes

Michelin Red Inner Tubes are compounded of certain quality-giving ingredients which prevent them from becoming brittle or porous and preserve the casing without stretching to fit the inside of the rim. This practically eliminates pinching when fitting.

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10 x 34	\$8.00	\$7.50
10 x 36	\$8.50	\$8.00
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10 x 40	\$9.50	\$9.00
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10 x 56	\$13.50	\$13.00
10 x 58	\$14.00	\$13.50
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10 x 62	\$15.00	\$14.50
10 x 64	\$15.50	\$15.00
10 x 66	\$16.00	\$15.50
10 x 68	\$16.50	\$16.00
10 x 70	\$17.00	\$16.50
10 x 72	\$17.50	\$17.00
10 x 74	\$18.00	\$17.50
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Notice the curve to which the Michelin tube naturally hangs—instead of being nearly a straight line, as in the case of other tubes. This curve is the result of the shape of the casing, which is made of a special material. This curve is not only a matter of appearance, but it is also a matter of safety. The curve of the casing is the only way in which the casing can be made to fit the inside of the rim. This curve is the only way in which the casing can be made to fit the inside of the rim. This curve is the only way in which the casing can be made to fit the inside of the rim.

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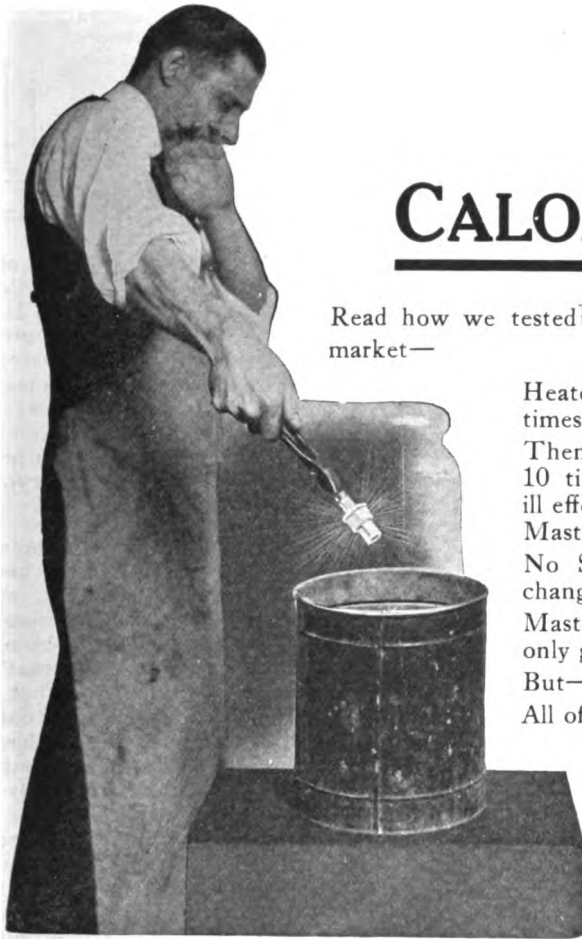
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MASTER CALORITE SPARK PLUGS



Read how we tested Master Calorite Spark Plugs before placing them on the market—

Heated them *Red Hot* and plunged them into cold water 26 times—

Then heated them *White Hot* and plunged them into cold water 10 times. They stood up under these radical tests showed no ill effects whatsoever. They proved themselves worthy the name Master.

No Spark Plug is ever subjected to such violent temperature changes in service—

Master Calorite Spark Plugs are built throughout to withstand not only great extremes of Heat and Cold

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All of the abusive trip hammer blows inflicted by the thousands upon thousands of cylinder explosions—

Furthermore

They will withstand a higher electrical voltage than porcelain, insuring positive insulation. Constructed of the finest material obtainable—these Quality Spark Plugs should immediately recommend themselves to discriminating buyers.

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CARS SENT FROM THE FACTORY

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Dealers replacing plugs—will do well to install Master Plugs—thus giving the car owner real service and gaining a loyal and satisfied customer.

Car Owners—Should demand Master Calorite Spark Plugs—They put a genuine spark of Life into the Heart of the engine—

Once installed—Ignition troubles are forgotten. "You pay a little more, but you get the worth of your money"—

Our guarantee shows our confidence in the ability of Master Calorite Plugs to make good under all conditions.

"We guarantee MASTER CALORITE SPARK PLUGS against defects of material or workmanship, and will replace free of charge, any CALORITE insulators broken by heat, which are returned to us transportation prepaid."

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Six Styles—Half Inch Regular—7-8 in. Regular—Metric—Model "F" for
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Manufactured and Guaranteed by

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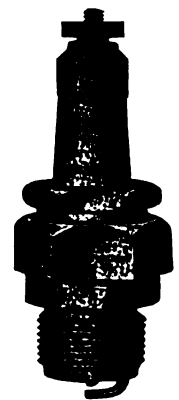
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Calorite Spark Plug
Extra Long, \$1.25 Each



MASTER

Calorite Spark Plug
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Secretary - - - D. O. BLACK, JR.

Published the 10th and 25th
of each month by the
AUTOMOBILE JOURNAL PUB. CO.,
Times Building, Pawtucket, R. I.

BECAUSE So Many Subscribers have inquired regarding private garages, the Editor has deemed it advisable to publish a general discussion of the subject, the first installment of which appears as the leading article of this issue. The majority of inquiries have related to portable, all-metal types, and for that reason the initial story concerns those models especially. The permanent structures, those made of wood, concrete, stucco, brick, etc., will be discussed in a succeeding installment, particular attention being devoted to the beautiful effects that can be obtained, the methods of construction and the cost and other essentials that would be of interest to car owners generally.

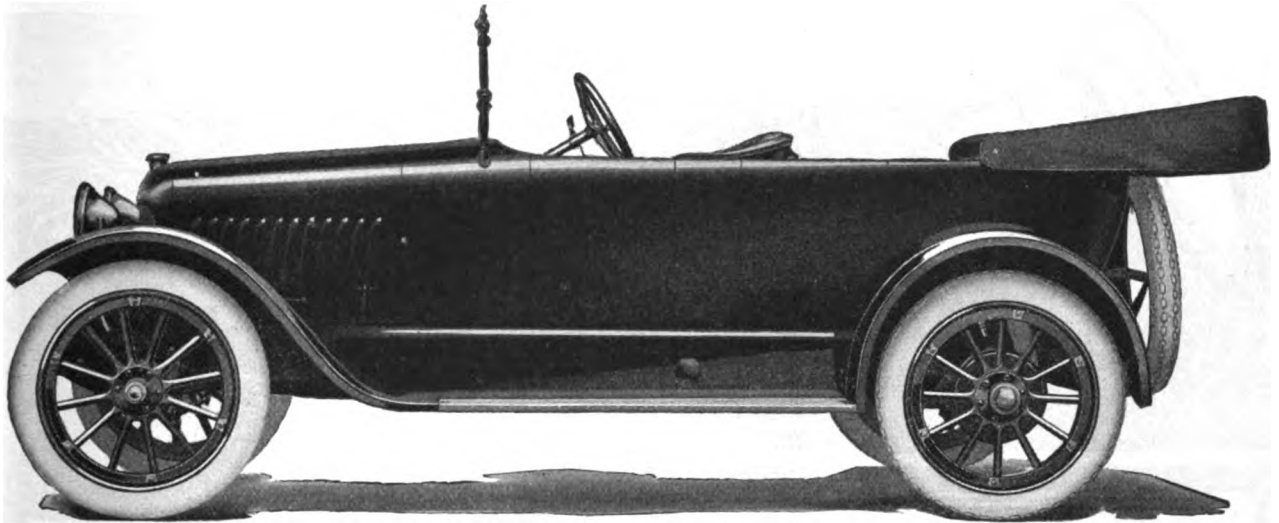
THAT New England this season is to be the touring ground for a larger number of motorists than usual is evident in the numerous requests from subscribers for touring information of that section. The inquiries come from practically all states, even those beyond the Mississippi and south of the Mason-Dixon line, and show an increasing general interest in the lures of New England's mountains, resorts and famous highway system. As in the past, a large part of The Automobile Journal's Annual Touring Number, to be issued July 10, will be devoted to detailed touring data covering the six New England states, though the other sections of the country will also receive adequate representation.

IN CONNECTION with Touring information, the Publisher wishes to remind subscribers that The Automobile Journal has been chosen among all other motoring magazines in this country as the official organ of the Touring Information Bureau of America. This arrangement makes it possible for readers of this publication to obtain free of charge any special touring information re-

lating to any section of the country by writing to the bureau at its Kansas City, Mo., office. The information given is exceedingly comprehensive and dependable, and includes several distinctive features not to be obtained in any other manner. Subscribers are urged to investigate the free service offered by this bureau.

AS A MEANS for keeping informed as to the new developments in motor vehicle equipment and accessories, there is no better medium than The Automobile Journal's department devoted to that service. Care is taken that only the best and most dependable articles are described and that each description is sufficiently complete and non-technical as to be of actual service to the readers. When writing to the manufacturers or distributors, it is advisable to mention that the description of the article inquired about was seen in this magazine.

THIS Year's Cruise of the Society of Automobile Engineers, which begins at Detroit on June 12, promises to be the most productive of valuable motor vehicle information resulting from any like session ever held by the S. A. E., and the more important and generally interesting discussions presented will be published in succeeding numbers of The Automobile Journal. The members of this society are admittedly at the heads of their respective departments in automobile engineering practise, and anything they have to say is of relative importance to every car owner. Among the subjects scheduled for discussion appears Kerosene Versus Gasoline in Standard Automobile Engines, Possibilities of the Constant Pressure Cycle, Vehicle Suspensions, Differential Substitutes, the Pneumatic Tire and Rim Situation, the Farm Tractor, Refinements in Truck Design, Automobile Experience in the Great War and Factors of Safety.



Announcing the 1917 **GRANT SIX**

THE 1917 Grant Six is brimfull of value. It creates its own enthusiasm. With a body of rare beauty it unites a mechanism that is thoroughly tried out and developed. There is nothing about the Grant Six that savors of conjecture, speculation, or experiment.

*Note these
Value-facts—*

Six-cylinder Overhead Valve Motor of Exclusive Grant Design, 3x $\frac{1}{4}$ bore and stroke—
Wagner Two-Unit Starting and Lighting System—
Remy Special Grant Ignition—
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Stewart Vacuum Feed with 12 gallon Tank in Rear—
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Drop Forged Front Axle—standard I-beam with extra strong steering connections—
Long Semi-elliptic Front Springs—
True Cantilever Rear Springs—shackled at both ends and pivoted in centre—
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112-inch Wheel Base—
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Willard Storage Battery—
Complete Equipment.

5-Passenger Touring Car	..	\$ 825
3-Passenger Roadster	..	825
3-Passenger Cabriolet	..	1050
f. o. b. Factory		

And These—

Grant owners average 20 miles to the gallon of Gasoline—(some say 28 miles) 900 miles to 1200 miles to the gallon of oil.
Grant Six throttles down to 2 miles an hour on high gear—speeds up to 50.
As a hill climber Grant Six is without a peer. Its records prove it.
These facts forced Grant production to 20,000 cars. These facts built the Grant Sales Organization of over 1200 Live dealers.
And the Grant Six is now backed by a corporation with \$4,000,000 capital.
For further interesting information write

Grant Motor Car Corporation, Findlay, Ohio



It's the same old COES

How often have you heard the repairman, machinist or shop manager say, "It's the same old Coes, just as good as the day I bought it—it will last forever."

That is evidence of the quality that has made Coes wrenches the standard the world over.

Coes Wrenches made today are just as good as the Coes Wrenches produced 50 years ago.

The material is selected with the same care, made by equally experienced and trained wrench makers, in a factory which specializes in wrench making. The wrenches are finished carefully and many times tested to assure the quality that will meet every requirement placed upon them.

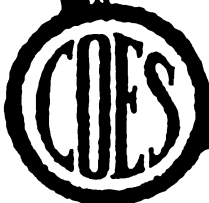
Car owners who know wrench values demand the Coes. It is most popular with automobile repairmen, and in every other line of mechanical work Coes Wrenches will be found on the benches and in the tool kits of the expert workmen.

Coes wrenches can be had in just the size to fit any use. Any Coes will afford the same long and satisfactory service. It is always dependable and from the standpoint of wrench service it is the cheapest wrench produced.

Coes wrenches are sold wherever motor cars are used. They may be had of all jobbers, automobile supply houses, and automobile and hardware dealers.

Catalogue on request.

Coes Wrench Company, Worcester, Mass.



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This New Regal Sweeps Aside Old Ideas of Values

\$695

Regal 4-Thirty-Two Features

☐ **Motor $3\frac{1}{2} \times 4\frac{3}{4}$** —A betterment of the Regal 4 Cylinder standard motor that has made good for years.

☐ **Wide Seats**—Rear 46 inches with leg-room and luggage room to spare.

☐ **Two Unit Starting Lighting and ignition with efficient generator-magneto device.** One-switch control.

☐ **Dash instrument all in easy sight and reach**—lighted by dash bulb.

☐ **Cantilever spring suspension for easy riding comfort.**

☐ **Semi-gloss, grained upholstery.**

In this new Regal-4-Thirty-Two we believe that never before have so many qualities of luxury and satisfaction been combined at such a price.

In point of style and appearance it is a worthy associate of the more expensive cars.

In all-round performance it yields to no car on the road, regardless of price.

Developing 32 horse power, it holds power in leash for every possibility.

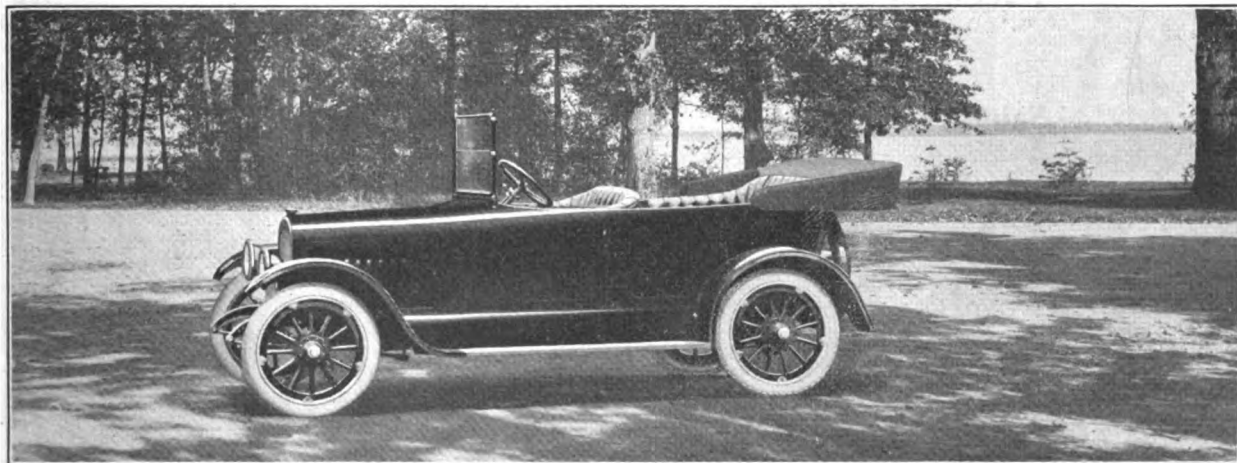
Seating generously five passengers, with leg-room and seat-room to spare, its perfect balance and cantilever spring suspension give riding comfort hitherto unlooked for in this price class.

Light weight and new carburetion ideas make this Regal unusually thrifty of gasoline.

Before we put the Regal nameplate on this car it plowed the sands of Michigan, conquered every hill between Detroit and Philadelphia, via Pittsburgh, passed successfully thousands of miles of tests to prove every contention we make in this announcement.

Your request will bring illustrated catalogue on the Regal-4-Thirty-two and complete information as to dealer possibilities.

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Regal-4-thirty-two

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NEXT to the car itself the subject that most concerns every motorist is how to provide proper housing facilities for it. In choosing a home for the machine he is restricted to either the public garage or one of his own, and, all things being equal, the majority will generally decide in favor of the private garage. The advantages of having one's own garage are obvious, the two chief considerations concerning the economy and convenience to be derived from such a building.

Aside from convenience and economy there is another factor to be considered, one that is becoming more pressing as the flood of cars turned out by the makers becomes greater. Even now space in public garages is at a premium, and one frequently hears of a car owner offering a comparatively large sum for the simple privilege of storing his car in a neighbor's barn, because he cannot find accommodations in a dependable public institution. Matters in this respect will not improve, to the contrary they will become worse.

As regards the economy effected by having a private garage, the most obvious item is that concerning the saving in monthly storage bills. Other advantages relate to the lessened likelihood of the car's finish being marred by careless workmen, of tools and equipment becoming "lost" and the elimination of the other abuses to which automobiles are too often subjected when placed in an undependable public garage. Experience has also shown that the gasoline bill shows a smaller monthly average when the car is stored in the owner's

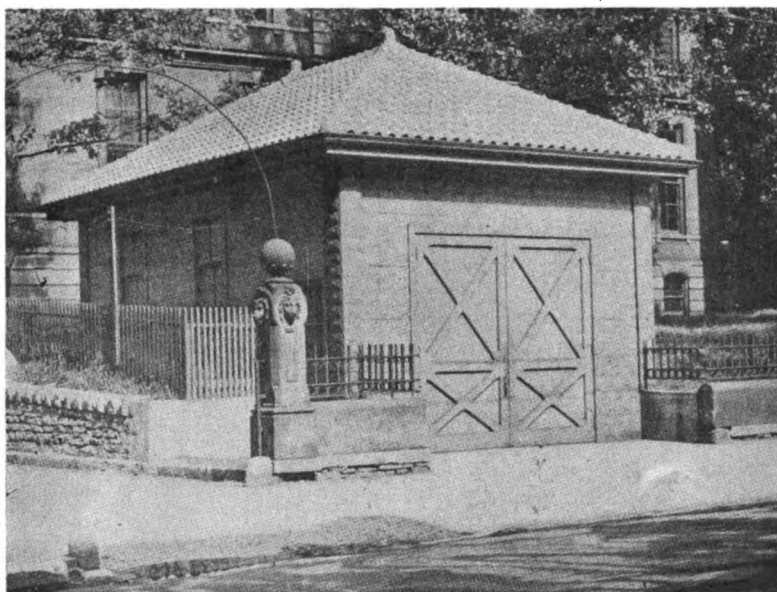
private garage and under his personal care.

It would seem unnecessary to mention the various items that come under the head of convenience, because they are so apparent to everyone who gives the matter any consideration. Probably the chief advantage is that the owner always has his car near at hand, ready for instant service at day or night. Another advantage is that the motorist who is inclined to "fuss" around the machine can spend his leisure moments in the garage, which he could not conveniently do if it were stored in a public station. He is afforded opportunity to make at his convenience those minor repairs and adjustments which he noticed were needed when he last used the car. In this way he can keep the machine tuned up to the highest pitch and obtain a greater degree of satisfaction from it.

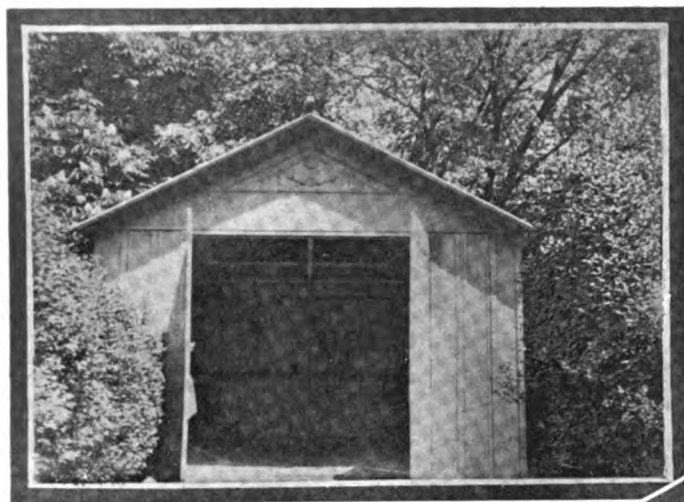
Having decided he will provide a private home for his

car, the owner is confronted by problems nearly as momentous to him as when he was considering the purchase of the machine. Probably the first thought is, how much shall I spend? That decided the next question is, shall the garage be permanent or portable? The third important consideration is the material of which it shall be built. Each prospective garage owner will decide these questions for himself, he best knowing how much money he can afford to invest and the conditions to which he must conform.

Irrespective of the expense involved, the garage must be thoroughly practical. First of all it should afford complete



An Exceedingly Attractive All-Metal and Portable Private Garage, the Walls Being Covered with Rock-Face Metal Siding, and Hipped Roof with Metal Spanish Tile—This Is One of the Several Models Made by the Edwards Manufacturing Company.



protection, not only against the elements, but against theft and fire hazards as well. Do not skimp on the size; a structure that is too small to allow room for the owner to work conveniently around the car will be a constant source of regret. And do not ignore appearances. A structure which harmonizes with its surroundings, and is made attractive by the use of vines, flower beds and trellis work, has both aesthetic and selling value. An unsightly building will prove offensive to both the owner and his neighbors.

As regards a permanent or portable type of garage, the motorist will judge according to his needs. Both have their advantages and should be given thorough consideration. In the case of the portable type the motorist who does not own the house in which he lives will find that kind a decided convenience, because if he should change his residence it is a simple matter to dismantle the portable garage and transport it to the new location. Another advantage is that it can be easily taken to the mountains, the country or the seaside during the vacation months, thus avoiding the necessity of having two garages.

It is the metal portable type of private garage that will be discussed in this article. The wooden, concrete, hollow tile, brick and stucco types will be described and analyzed in another installment.

Advantages of Portable Garages.

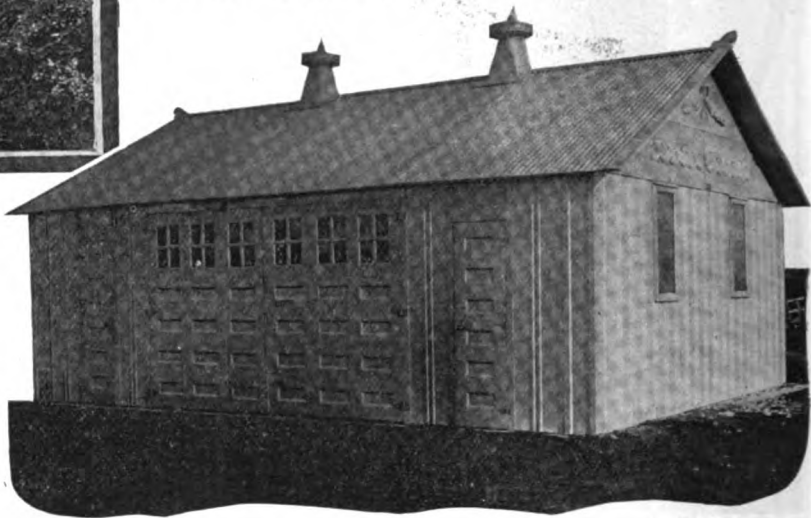
The portable garage has been characterized as the average man's garage, largely because of its great utility and its inexpensiveness. Being mostly of metal they are fire, weather and damp proof, strong, substantial, clean, sanitary and generally attractive. In cost they range from \$45 to as high as \$1000. Upkeep is a negligible factor, the chief item

being a coat of paint, occasionally applied.

The portable garage has proved to be a decided boon to all classes of motorists. An ever increasing large number of city dwellers make a practise of shipping them to the country or seashore at the beginning of the vacation period to provide a house for their cars, bringing them back in the fall, thus making one structure serve their needs in both places of residence. Motorists dwelling in the country have found them to be very desirable, largely because of their strength, durability and ease in handling.

A Garage for Every Need.

There is opportunity for wide choice among the structures now being offered by manufacturers, several distinctive de-

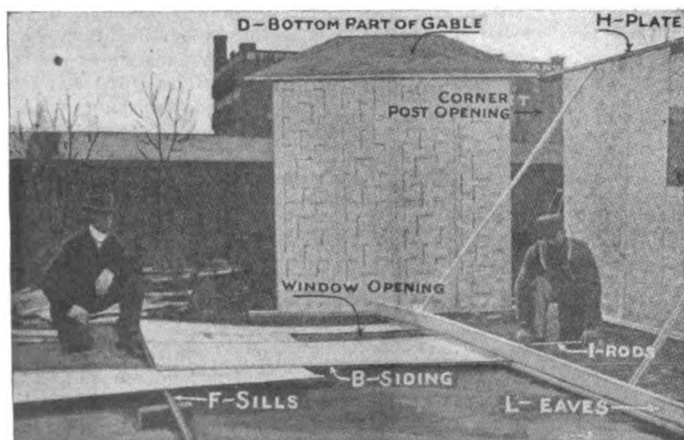


Two of the Hundreds of All-Metal, Portable Garages Made by the Metal Shelter Companies—Structure at Top Is a Simple One-Car Type, Known as the Pruden Garage, While the Other Is One Used by Ralph De Palma at Chicago Speedway as a Service and Storage Station.

signs being shown in accompanying illustrations. They can be had in either all metal or wood, or a combination of both, and in any size from the type designed for one car up to large sectional community units that can be made to house any number of machines.

As regards exterior appearance they can be obtained in imitations of brick, shingle, weatherboard, stucco, rubble stone, and, in fact, in any of the finishes known to architects and contractors. The owner can have a roof of either cluster metal shingles, plain plate or imitation metal Spanish tile. In window designs he has the choice of ordinary two-section types, full length opening windows, and units that tilt on pivots. He can obtain single or double swinging hinge doors, sliding or rolling single or double types and made of either wood or steel, or their combination.

One valuable feature of the portable garage that will appeal to the motorist who desires to economize in expense by erecting it himself, is that these structures are "ready



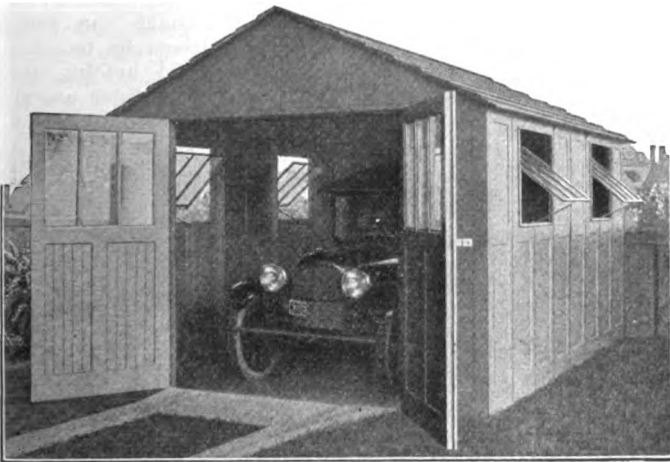
How Metal Shelter Garages Are Assembled—Interlocking Wall Units While Flat on Ground Ready to Be Erected Like Sections Shown in Background.



Attaching Ridge and Hanger Brackets, and Inserting Corner Units by Thrusting Upper End of Unit into the Eaves and Gable Channels.

made" that is, they are made to a pattern by the manufacturer and shipped ready to be put together. In all cases the manufacturer supplies working drawings and numbers and otherwise designates each part so that they can be assembled very easily with wrench, screw driver and hammer. In fact they do everything but put up the garage, and in some cases they will even undertake that work.

Except for the individual design and the difference in application of the principle, the numerous types of steel garages may be said to be similar in construction to the one described in the accompanying views, which show the different stages of operation in putting together one of the garages made by the Metal Shelter Companies. This company is one of the



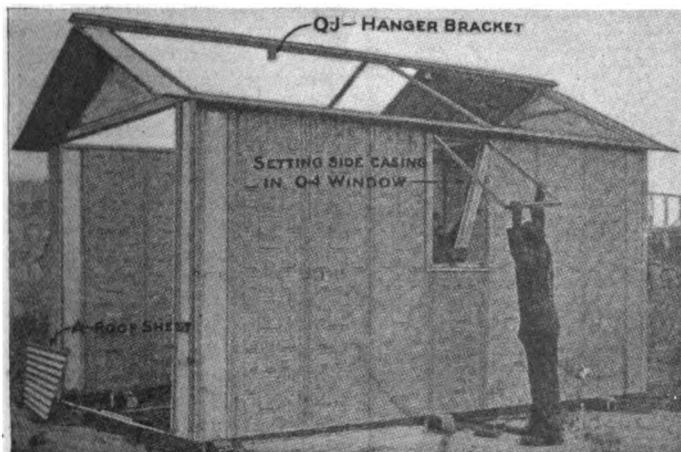
An Abundance of Light Is Provided for in This Kahn Portable Steel Garage, One of the Many Models Made by the Trussed Concrete Steel Company.

leading manufacturers in its field, having branches in the larger cities of the country, with headquarters in the Whitehall building, New York City, and manufacturing hundreds of different designs to range in prices from \$100 to as high as \$1000.

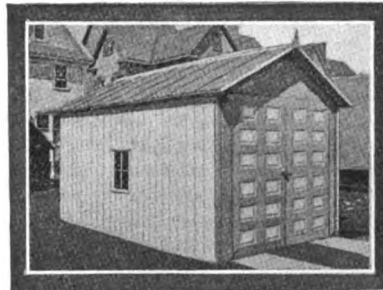
Durability and serviceability are the outstanding features of these structures, they being made of heavy gauge steel thickly galvanized and joined together in a system of interlocking sectional units. The sections are so held together—bolts and rivets are not used—that every joint is tight and weather proof.

The side and end walls are joined by studs, which form a part of the integral wall after they are locked in place. The edge of each sheet is formed into a hook, or bead, which interlocks with the bead of the next section, thus forming a tube into which a rod is slipped to hold the sections together. This construction is very similar to that of a door hinge and extremely practical.

The rods are then bolted to the bottom piece or sill, fastening the whole wall into one solid piece of sheet metal. The sills are of angle iron and are anchored to the foundation by



Inserting Pushout Windows and Placing Side Casing—Doors Are Installed in Much the Same Manner, and Either Windows or Doors Can Be Placed Where Desired.



The "Only" Garage, a Combination of Wood Frame and Steel Covering and a Very Serviceable and Attractive Home for the Automobile—Made by the Ashley Steel Building Company.



An Illustration of How All-Steel Garages Can Be Made to Harmonize with Its Surroundings—This Is a Kahn Portable Steel Building.

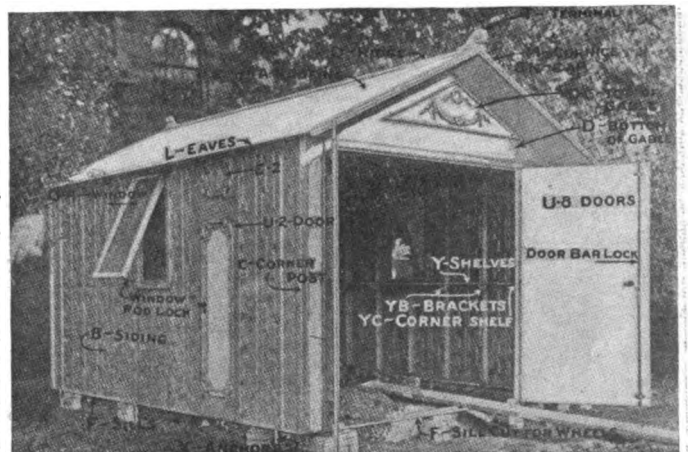
means of specially constructed clips held down by bolts embedded in the concrete foundation.

Before being slipped into the tube formed by the heads of the two sheets, the studs are put through holes in the eaves pieces so that when they have been fastened to the sills at the bottom the eaves also are held in place at the top of the wall sections. The outer edges of these eaves sections are bent over to receive one of the pieces which are slid into the slot thus made and which span the space between these eaves ends and the ridge piece at the top of the roof. There is a similar slot in the ridge piece to receive the other ends of the metal roof sections. The roof sheets are fastened together by means of beads, but there are no studs, as in the side wall sections.

How to Assemble Portable Buildings.

In accompanying illustrations are shown the details of construction and how the sections are joined in a rigid and durable unit, while another view shows a completed garage, which was erected for Ralph De Palma, the racing driver, at the Chicago speedway. The De Palma garage measures 20 by 26 feet, with a nine-foot wall, and, built complete, even including keys for the Yale locks and two large ventilators, cost but little more than \$900.

Metal Shelter garages are exceptionally well built and high grade and are designed to be used in any climate and during summer and winter, it being possible to insulate the walls to keep out the cold. The sections can be obtained to represent cut stone designs, battened stucco and panelling effects. All wall units are interchangeable, so that any door,



The Completed Building, Ready for Floors, Showing Names and Locations of Various Parts and Arrangement of Shelves and Brackets.



An Excellent Example of an Ornamental All-Wood Portable Garage, Which Is Manufactured by the J. A. Catherman Company.

O., produces types made of steel over wood, as well as all steel. The first mentioned, which is designated by the maker as Steelcote, has a frame of seasoned wood covered with non-rusting galvanized steel. The entire structure, except beams, uprights, etc., on the inside, is steel, and this is made weather-proof by the Edwards Tightcote process, in which each sheet of metal is resquared after stamping and before galvanizing. It is made rust proof by being dipped into molten lead and zinc, which covers the edges and sides. This type is offered in a large variety of designs and exterior finishes and roofings, notable among which is the metal Spanish tile type and hipped roof. The wall sections are secured together by a patented interlocking construction, which makes the joints water tight and provides for expansion and contraction. The doors are wood body, metal covered.

The second Edwards model is designated as the All-Steel, and as its name implies, contains no wood in its construction. The roofing, siding, window frames and doors are of non-rusting galvanized steel, and the frame of open-hearth steel angle sections. Bolts and rivets are used to join the sections together and form a rigid structure. There is one centre brace and two transverse stress braces, riveted in place.

The siding is Edwards patented beaded lock joint, heavily galvanized by the Tightcote process, each section being equipped with a patented interlocking device which locks into stiffening bars, forming air tight joints between sections.

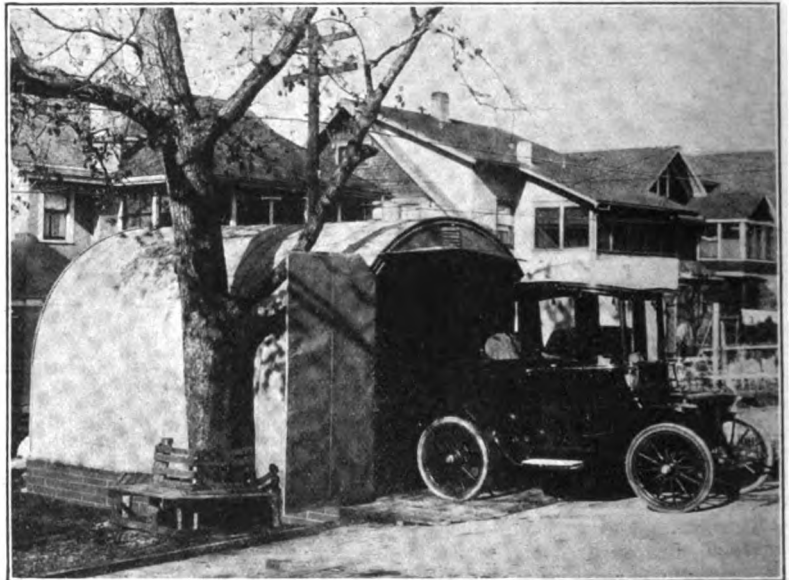
The roofing is of the same material as the siding and is securely locked by slipping into the folded part of the ridge cap and into the turned up edge of the eave flange. The roof is further reinforced by two extra angle steel purlins, extending from gable to gable. Two of the side sections have provision for metal fireproof window frames, and because these sections are interchangeable the windows can be located to suit the ideas of the owner.

window or other section may be substituted for any siding unit, thus permitting the location of such units at any point dictated by the desires of the owner.

Another large maker of portable garages, the Edwards Manufacturing Company, Cincinnati,

A third manufacturer of all-steel portable garages is the Trussed Concrete Steel Company, which maintains a huge plant at Youngstown, O. Its product bears the trade name of "Kahn Portable Steel Buildings," and is recognized as very high in quality and service. Like other high-grade, all-metal buildings, the different units are made in sections, so that they can be assembled as simply as building up a sectional book case. The parts are standard size and interchangeable, which allows the window and door panels to be located wherever the owner desires. Furthermore, additional sections can be added to a Kahn garage already erected to extend its length and provide room for more cars.

A distinctive feature of Kahn construction is the split bolt and wedge lock for joining the various units together. This consists of a special slotted bolt slipped through the holes punched at the factory, a wedge being driven by hammer into the slot extending through the metal and holding the sections firmly in place. This construction simplifies assembling and makes for a secure joint that is both tight and



A Novel and Practical All-Metal Private Garage, the Butler "Round-Ruff," Manufactured by the Butler Manufacturing Company.

weather proof. No rivets or bolts are used in Kahn garages.

In joining the roof plates a special joint strip is used. The roof plates have turned over ends, over which fit the strip joint to make them absolutely weather tight. When assembled the roof has the appearance of the finest grade of roofing tile. For fastening the plates to the interior trusses a special clip is driven over the flanges of both units, holding them together securely.

Another company producing all-steel, combination steel and wood and all-wood models is the Ashley Steel Building Company, 1790 Broadway, New York City. All Ashley gar-

ages are sectional and portable and the standard makes include structure for one and two cars, the all-steel models ranging in size from 10 by 14 feet, with eight-foot high side walls, to 20 by 22 feet. The combination and all-wood models measure 10 by 14 up to 12 by 24 feet. In price the all-steel garages cost from \$190 to \$485. The other models range in price from \$85 to \$280.

The all-steel type is designated as the "Angle Frame" garage, because the galvanized sheets are used only as covering, the roof and wind loads being carried on the rolled steel trusses, columns, purlins, etc. It is this feature upon



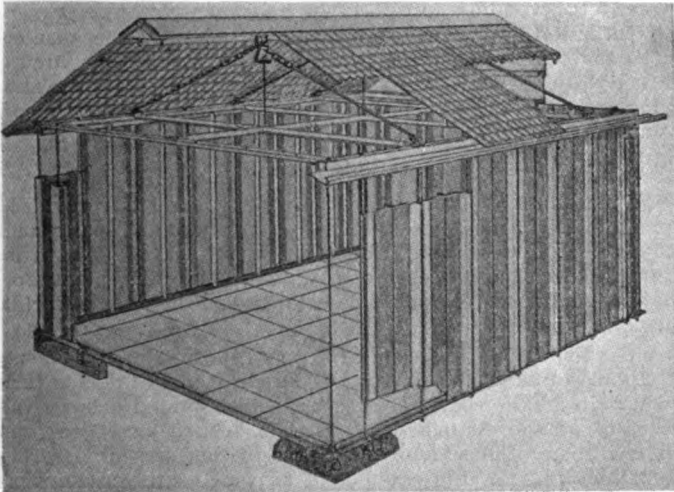
The Kenyon Take Down Garage, a Neat and Inexpensive Model Offered by the R. L. Kenyon Company—Note the Unusual Construction of the Door.

which the maker lays greatest stress in its profusely illustrated booklets describing its various models. The garages are built to withstand the maximum load of snow, the smallest being able to sustain a weight of 4800 pounds.

The combination metal and wood models are designed to meet the demand for a low priced building. The frame is made in sections and of seasoned spruce, this being covered with 26 gauge metal painted on both sides with a rust proof paint, or galvanized. All sections of Ashley garages are fastened together by patented interlocking, water proof, dust proof and wind proof joints.

All-Wood Ashley Models.

The all-wood model differs in essentials from the combination type in that the construction throughout is of wood. The covering consists of a three-ply wood veneer, the three thicknesses being cemented together under 50,000 pounds pressure with a special water and heat proof cement. The roof is covered with a heavy granulated slate roofing material which can be had in green or red.



Sectional View of the Construction of Metal Shelter Portable Garages, Showing How the Various Units Are Assembled.

In one of the accompanying illustrations is shown a round roof, all-steel garage, the product of the Butler Manufacturing Company, Kansas City and Minneapolis. The keynote of this type is inexpensiveness, simplicity and strength. The Butler Round-Ruf, as this model is called, is made either of galvanized sheet metal, or of sheet metal painted gray, and in four standard widths—10, 12, 14 and 16 feet. They can be had in any length in multiples of approximately 34 inches. They are shipped in sections and are easily assembled by means of bolts and special interlocking joints which are supplied.

The foregoing will indicate to the reader the general features of construction and assembly of the various types of portable garages being offered by manufacturers, and will form a basis for further investigation. There is a large number of makers, prominent among whom are the following companies:

The Brooks-Skinner Company, Inc., Quincy Point, Mass., one of New England's largest manufacturers of all-steel garages.

The J. A. Catherman Company, Beaver Springs, Penn., which makes all-steel and wooden portable garages of all types and sizes and at very low prices.

The Farrar Lumber Company, Dalton, Ga., producer of wooden and steel-clad automobile houses, the prices of which range from \$48 up to \$95.

The C. C. Fouts Company, Milledale, O., which offers all-metal sectional models "small enough for a runabout or large enough for any touring car" at \$100, \$110 and \$120.

The Ruby Manufacturing Company, Jackson, Mich., which builds sectional and portable, all-metal structures, measuring from six to 30 feet wide and from 10 to 500 feet in length.

The Diamond Hardware Manufacturing Company, 219 Diamond street, Pittsburg, Penn., the maker of portable fire proof steel and steel covered combination garages, which the company will either sell or rent at very moderate prices.

The Garage Construction Company, Oliver avenue, Pittsburg, Penn., whose prices range from \$40 to \$168, and whose models include steel, steel cote, frame, concrete and brick type, which the company will erect for the purchaser or will rent by the month.

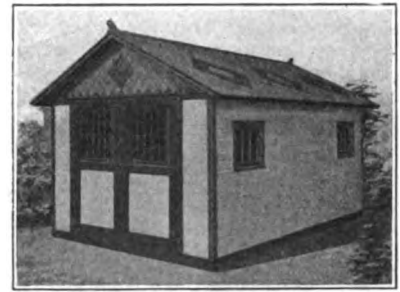
W. M. Dougal, 1410 G street, Washington, D. C., which specializes in steel portable garages that range in price from \$130 to \$170.

Among the manufacturers of "ready made" wooden garages probably the most widely known is the North American Construction Company, Bay City, Mich., the maker of "Aladdin Homes." This company sells direct to the consumer the material needed to erect a garage or any other kind of a structure, each piece being cut exactly to fit in the designated place. Its standard garage models range from small car types, either in all wood or combination wood and metal, to a 20 by 20 foot two car type, the prices being from \$46.55 up to \$233.70.

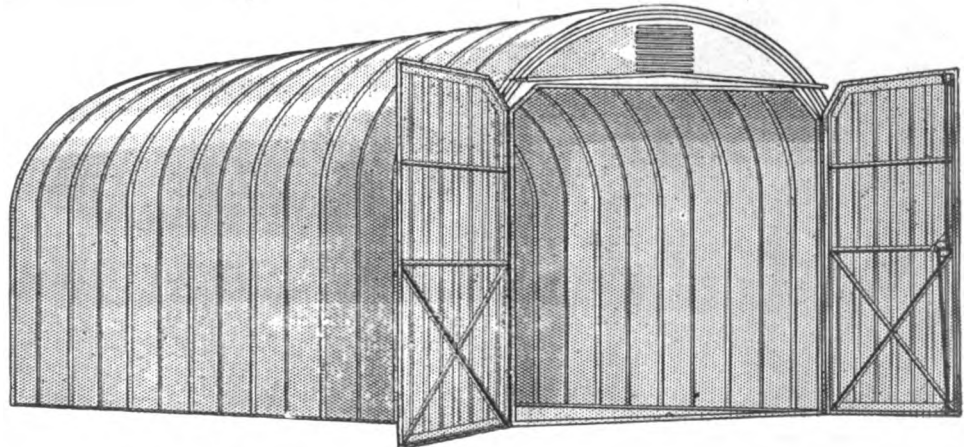
At the top of this page is shown an illustration of one of the all-wood portable garages built by the St. Johns Portable Building Company, St. Johns, Mich., a concern that operates one of the largest factories of its kind in the United States and has been nationally known for the past seven years for its high grade product. Standard sizes of St. Johns garages range from 10 by 14 up to 18 by 22 feet, while larger structures and special designs can be obtained at practically the same price as the standard buildings. This company has a widely diversified line, which it describes and illustrates in booklets that are free upon application. Its lowest priced standard garage sells for \$76 without floor and \$90 with floor, while the highest priced, without floor, costs \$220, and with floor, \$256.

The Mershon & Morley Company, Saginaw, Mich., manufactures a large variety of portable ready built buildings, a number of which are distinctive garages designed to meet the requirements of all classes of motorists.

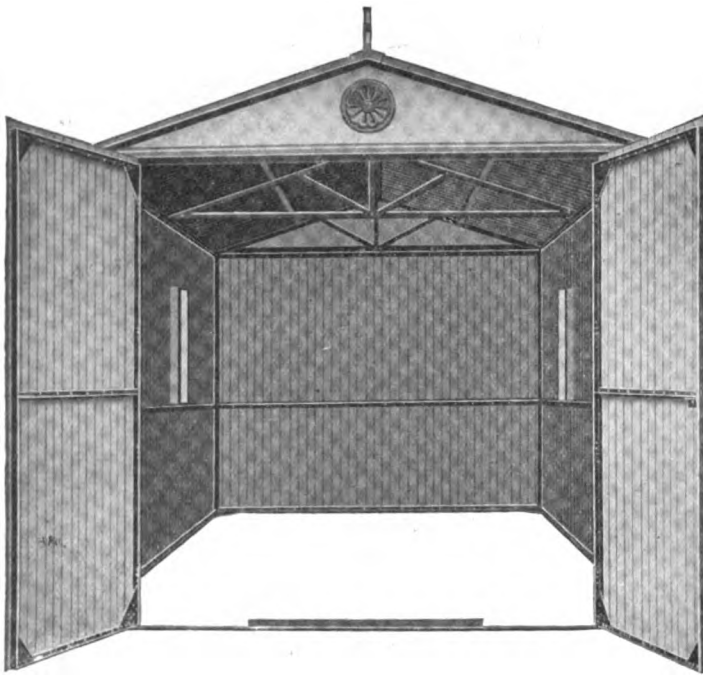
The Kenyon "Take Down Garage," made by the R. L. Kenyon Company, Waukesha, Wis., is a serviceable home for an automobile. A view of this garage is shown in an accom-



The St. Johns Sectional and Portable All-Wood Garage, a Distinctive and Inexpensive Model.



Another View of the Butler "Round-Ruf" Garage, Affording a Better Understanding of Details of Construction.



An Interior View of an Edwards All-Steel Garage, 12 by 18 Feet, Showing How Building Is Braced and Securely Locked Together.

panying illustration. The small model can be bought for \$54, without floor, while the largest size, 12 by 20 feet, costs without floor \$121.50 and with floor \$150.

Factors to Be Considered.

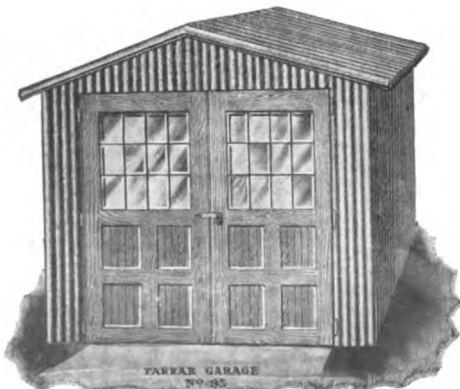
When considering the purchase of a garage the car owner should bear in mind that it is better to have plenty of space than to be cramped for room. A building that is too small will prove a constant source of regret, because many necessary repairs cannot be made owing to lack of space. Furthermore, the present owner of a small car may later buy a larger model and discover he cannot get into the garage.

It is advisable to study the requirements carefully. Some of the factors which will enter into the decision concern the amount and character of work the owner intends to do within the garage. Will he have need for a lathe, drill press and emery wheel? What will be the source of power? How many work benches will be required? If none of this equipment is to be used then, of course, the motorist will not need a building any larger than will allow the car to be stored without danger of contact with the walls.

If he intends to make his own repairs he should allow reasonable working space, which may be understood to mean at least three feet of space in all directions from the car. In determining the height do not fail to take into consideration the space needed when the top is raised.

In many garages where space is limited collapsible work benches are frequently attached to the sides of the building. When in use they are held in position by two or more braces. Another plan is to build the benches in the corners, they being triangular in shape.

Location is an important factor in erecting a garage. It should be placed as near the street as consistent with good appearance and should have a direct approach. Before the door there should be a clear space in which to turn the car. The



The Farrar Steel Clad and Ready Made Combination Garage, the Product of the Farrar Lumber Company.

building should be set up on a level spot, and care be taken that water cannot seep into the interior. This danger can be prevented by raising the floor above the level of the surrounding ground.

As regards flooring, the consensus of opinion seems to be that concrete or cement give the best service, if laid properly, and endure the longest. Some motorists advocate gravel or cinders because of their inexpensiveness and because they have proved in long practise to answer all normal requirements. The chief objection to wooden floors in a garage is that they are likely to become saturated with oil and gasoline and consequently prove hazardous in regard to fire. Whatever material is used, the garage should have a drain, preferably one in the centre, the floor being sloped so that surplus water, etc., will flow into it.

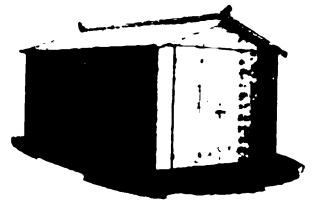
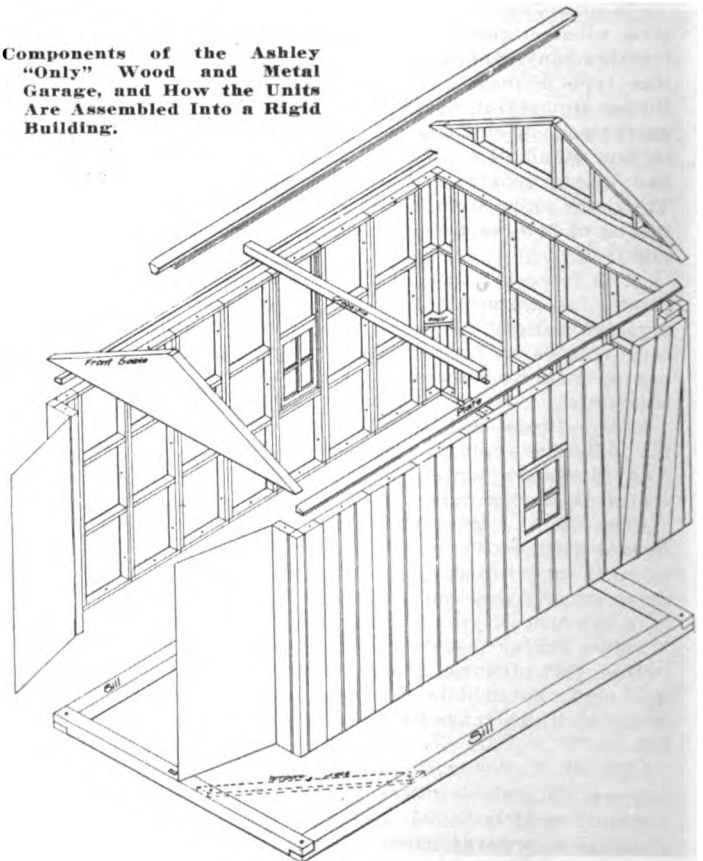
Ventilation is of prime importance in a garage, because of the danger attendant upon the collection of gasoline fumes in a tightly closed building. When in some cases doors and windows are sufficient, it is advisable to have one or more vents in the roof.

Ample Light Essential.

Windows in the roof or on the sides should be provided, and the light should be plentiful. Many needed repairs and adjustments are often overlooked in a dark garage, and it is difficult to clean the car properly unless one has plenty of light. Furthermore, a light interior makes a more cheerful place in which to work.

It is impossible to set an arbitrary rule for the equipment and tools to be used in a garage. Experience will decide this point. In another part of this issue will be found a large variety of garage equipment which has been selected to provide a liberal choice for the readers of this magazine. The manufacturers of this equipment, as well as the makers of the garages described in this article, have profusely illustrated booklets describing their products which they will send to inquirers, who should mention this magazine when writing.

Components of the Ashley "Only" Wood and Metal Garage, and How the Units Are Assembled Into a Rigid Building.



Century Sectional and Portable Garage Manufactured by the C. C. Fouts Company.

TRAFFIC ACCIDENTS IN NEW YORK.

Classified Tables of Police Department Show Facts of Interest to All Drivers of Motor Vehicles.

Some highly illuminating figures are contained in the classified tables of highway accidents of the New York City police department for 1915. These tables show conclusively that the most effective ways for reducing the number of highway accidents are to provide playgrounds for children and to educate pedestrians of all ages to observe as much caution in crossing streets as drivers observe in handling their machines, whether horse drawn or motor driven.

In the record can be seen evidence of the fallacy of attempting to reduce the ratio of accidents materially by requiring all operators of motor vehicles to be licensed, while no such regulation is applied to drivers of animal drawn vehicles. Even more evident is considered the uselessness and unfairness of enacting ordinances requiring the fitting of fenders to motor trucks, which were the cause of less than half as many accidents as horse drawn wagons.

The table shows that of 10,653 accidents of which the causes were given, 8661, or more than 81 per cent., were due to the fault or incapacity of the injured person, and only 700, or 6½ per cent., to the fault of the driver. The accidents are classified as follows:

	Killed	Injured
Horse drawn vehicles....	100	2341
Motor trucks	105	1107
Automobiles	177	4688

Street cars, which are equipped with fenders, killed 77 and injured 1694 persons during the year, as against 105 killed and 1107 injured by motor trucks, although there were only 12,000 electric street cars in operation in the city, including subway and elevated cars, as compared with 12,575 commercial motor vehicles, which were not fitted with fenders.

MASSACHUSETTS ACCIDENTS.

Automobile highway accidents are on the increase in the State of Massachusetts, according to the table of statistics issued by the Massachusetts Highway Commission for the year 1915. There was a total of 10,175 automobile accidents, in which 271 persons were killed and 5474 were injured, and of the total number 7575 occurred between sunrise and sunset, while the remaining 2600 happened during the night time. The majority of the accidents occurred on the streets of cities or towns, the total being 9078, as compared with 1097 on country roads.

Of all the accidents 3308 were between automobiles, 3201 were between machines and pedestrians, 1149 automobiles and carriages, etc., 521 automobiles and bicycles, 594 collisions with street cars, 998 striking poles, curbs, etc., 24

collisions with trains, 364 hitting horses, dogs, etc., 16 miscellaneous.

The list of casualties from automobile accidents were:

	Killed	Injured
Pedestrians	181	3038
Occupants of automobiles	83	1515
Occupants of carriages...	4	419
Bicycle riders	3	490
Street car passengers....	0	12
Totals	271	5474

LARGE WAGER MADE ON MERCER.

Out of an argument that a stock Mercer model could make a speed of 90 miles an hour or better grew a wager of \$500 and a test by George R. Bentel, California distributor for Mercer cars, on a guarded mile stretch of the National boulevard. A stock 22-72 raceabout, just received from the Trenton factory, was sent over the course with Bentel at the wheel and an official observer accompanying him. The first trial netted 92 miles an hour, which was repeated in a second try out. At the time the trial was made the car carried lamps, fenders and two extra wheels and tires.

NEW JERSEY ROAD MAP.

For several years the States Garage, Atlantic and Delaware avenues, Atlantic City, N. J., has made it a custom to issue a touring map and data concerning

all the best routes of New Jersey and adjoining states that lead to the great eastern seaside resort and to the States Garage. The 1916 edition has been issued and shows all the principal connections, as well as the through routes. The map is copyrighted by the American Automobile Association and is valuable to any motorist intending to travel in New Jersey.

ANOTHER KING RECORD.

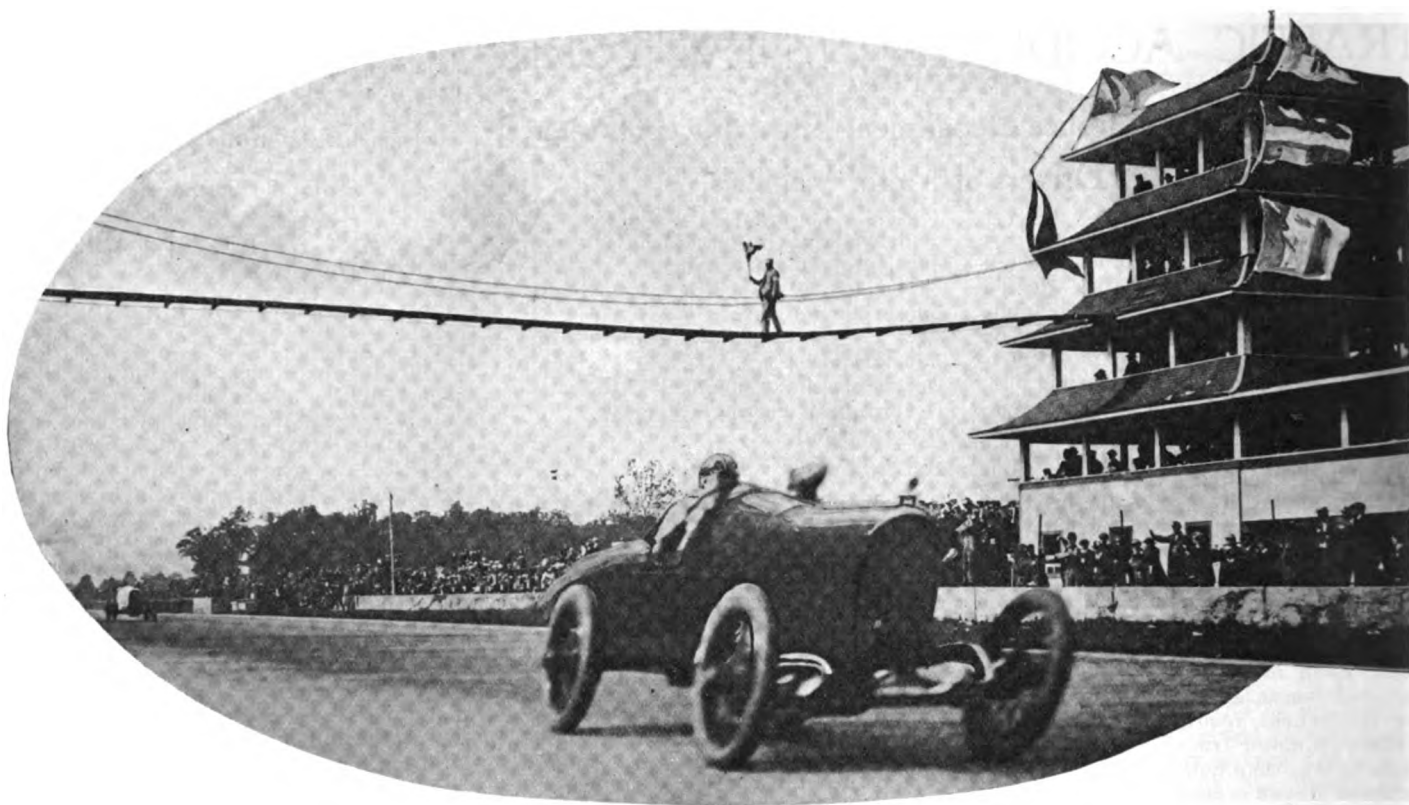
Another high gear record has been added to the list of stock car achievements by the King eight-cylinder car. The latest was established recently in New England, the car running 544 miles up hill and through pouring rains and all the time on high gear. The route led from Providence, R. I., to Worcester and through the Berkshires to Lenox and thence down the Hudson river to New York City.

One of the main features of the trip was that the car had been taken direct from a freight car and carried seven adult passengers, who together approximated 1270 pounds weight. The gear shifting lever had been removed and the transmission housing sealed to prevent any tampering with the gears. The trip was staged by A. F. Justin, sales manager for the Longley Motor Sales Company, Providence.

At numerous points along the route it seemed that the car would be stalled, but to the contrary, it negotiated all hills, even 20 per cent grades that were quagmires of mud, with comparative ease. The New England run is being compared favorably with that made by Jerry Woodill in a King Eight in California a few weeks ago, which was described in the last issue of this magazine.



Artemas Ward, Jr. (Standing), President of King Motor Car Company, Welcoming A. F. Justin, Who Drove the King Eight on Its Recent High Gear Test in New England—R. S. Longley and H. J. MacKenzie of the Longley Motor Sales Company Are on the Rear Seat at the Left.



RESTA EASILY WINS INDIANAPOLIS CLASSIC.

BEFORE the first 50 miles of the International Sweepstakes races at Indianapolis had been covered it was evident, barring accidents, that Dario Resta, the canny master of racing motors, had the contest well in hand. At all times did he exhibit a well calculated method of procedure, he allowing the more impulsive drivers to set the pace and to take the chances of misfortune. So confident of the result and so careful was he of his machine that in the 69th lap, the 177th mile, he stopped at the pits to equip his car with a new right rear tire, although the one he was using was still in fair condition. Probably he had in mind the death and injury of so many of his fellow racers, due to their tires bursting.

His caution brought its reward, for at the finish he was leading the next man in line by approximately two minutes. Second to finish was D'Alene in a Duesenberg; Mulford was third in a Peugeot, the same make of car which Resta drove. Fourth and fifth were taken respectively by Christiaens in a Sunbeam and Oldfield in a Delage.

The time per hour this year was considerably slower than that of last year. Resta completed the journey in 3:34:15, at an average miles per hour of 84.05, while in 1915 in the 500-mile race De Palma averaged 89.84. In that year Resta, who came in second, made 88.91 miles per hour.

There was less mechanical trouble among the machines at Indianapolis

than was noticed at Sheepshead Bay. None of the five winners was forced to stop at the pits for this reason, the stops they did make being due to tire changes and the shipping of more gasoline and oil. Resta stopped his Peugeot once to change the right rear tire, as mentioned above, and to take on gas, he losing one minute and four seconds. D'Alene stopped his Duesenberg in the 52nd lap for a right rear tire and fuel, consuming one minute and 35 seconds at his pit. Mulford's Peugeot was pulled up only once, in the 72nd lap, he losing only 33 seconds to make the same changes as Resta and D'Alene. Christiaens drove his Sunbeam to the pits to change the left rear tire, in the 16th lap, consuming only 30 seconds. Oldfield made four stops, changing the right front tire twice, and the right and the left rear shoes once each. He took on gasoline and oil twice during these stops, losing altogether three minutes and 22 seconds.

As was the case last year, there was considerable rain on the days immediately preceding the race. This year, however, the rains had ceased and the clouds lifted on the day of the race. In fact, the brick surface of the course had dried so thoroughly that it felt hot to the hand. Approximately 83,000 spectators were assembled when the 21 cars came out for the preliminaries, which consisted of sending each car around the course once to introduce the entry to the crowd.

At the end of the first lap the cars were strung out so that the entire ellipse was dotted with machines. First across the line was Eddie Rickenbacher in the



Resta in the Winning Peugeot in Which He Averaged 84.05 Miles Per Hour at the Indianapolis Speedway on May 30.

SUMMARY OF THE SIXTH INTERNATIONAL SWEEPSTAKES, SHOWING THE TIMES AT VARIOUS INTERVALS.

No.	Driver	Car	10 Laps 25 Miles	20 Laps 50 Miles	40 Laps 100 Miles	80 Laps 200 Miles	120 Laps 300 Miles	
1.....	D'Alene	Duesenberg	16:02	33:54	1:09:37	2:24:39	3:36:15	
4.....	Henderson	Maxwell	16:52	33:52	1:10:21	*2:24:15	*3:49:56	
5.....	Rickenbacher	Maxwell	Out in the ninth lap with a broken steering knuckle.					
8.....	L. Chevrolet	Frontenac	16:12	33:54	1:09:37	2:54:19	Out in lap 83, burned out rod	
7.....	A. Chevrolet	Frontenac	25:09	43:16	2:03:59	Out with fouled plugs and magneto trouble		
9.....	Halbe	Osteweg	16:54	36:01	1:15:01	2:34:19	4:03:10	
10.....	Mulford	Peugeot	16:54	35:33	1:12:08	2:20:44	3:37:56	
12.....	Alley	Ogren	17:04	35:39	1:16:44	2:41:39	Not timed	
14.....	Christiaens	Sunbeam	16:00	35:07	1:14:25	2:29:01	3:46:36	
15.....	Oldfield	Delage	16:24	35:26	1:11:47	2:30:55	3:47:19	
17.....	Resta	Peugeot	15:12	32:17	1:07:20	2:18:04	3:34:17	
18.....	Aitken	Peugeot	15:11	33:26	1:10:09	Out in 69th lap with broken valve.		
19.....	Merz	Peugeot	15:59	33:53	Out in 27th lap with lubrication trouble.			
22.....	LeCain	Delage	16:24	34:51	1:13:00	Out through accident.		
23.....	Franchi	Peusun	27:11	Out in ninth lap with engine trouble.				
24.....	Chandler	Crawford	18:42	40:44	1:19:43	2:47:07	4:02:43	
25.....	Lewis	Crawford	19:52	38:40	1:19:09	Out in 70th lap with loose fuel tank.		
26.....	Johnson	Crawford	17:44	39:02	1:19:13	2:40:55	4:01:55	
27.....	Rooney	Premier	16:01	34:05	1:14:29	Out in 48th lap, turned over.		
28.....	Anderson	Premier	15:59	33:39	1:14:34	Out in 75th lap with broken oil line.		
29.....	Wilcox	Premier	22:31	45:03	1:19:43	2:38:45	3:54:31	

*Rickenbacher replaced Henderson in 52nd lap.

Maxwell, which he piloted to victory at Sheepshead Bay. In the order mentioned followed Aitken (Peugeot), Resta (Peugeot), Anderson (Premier), Rooney (Premier), Merz (Peugeot), Wilcox (Premier) and Arthur Chevrolet (Frontenac), with the rest of the starters trailing far behind.

At the end of the second lap, five miles, Rickenbacher had opened a gap of 300 yards between his car and Aitken and Resta. In the 13th mile the flying Maxwell, which was doing about 90 miles an hour, lapped Johnson's Crawford, and continued to mow down the field. About a half mile separated Rickenbacher from his nearest follower. Aitken and Resta were battling, wheel to wheel, for supremacy, and when Rickenbacher's white Maxwell met grief in the ninth lap through a broken steering knuckle, Aitken shot to the front. With Rickenbacher out the two Peugeots were left a quarter of a lap ahead of the next driver, Mulford, in another Peugeot.

Many cars were falling by the wayside, going to the pits for tire changes, repairs and fuel replenishments. Conspicuous among these were the Premiers, Frontenacs and Crawfords, the first two being troubled by sooty plugs.

In the 45th mile Aitken was forced to surrender the lead to the persistent Resta, the former going to the pits to change the right rear tire. Though it required but 20 seconds, the delay was sufficient to allow the Italian-American speed king to gain a lead that he held thereafter throughout the contest.

Resta covered the first 50 miles in 32 minutes and 17 seconds, and the field had been cut down to 19 contestants, Rickenbacher and Franchi, who drove a Peusun, having dropped out. At 100 miles, which the leader had covered in one hour, seven minutes and 20 seconds, two other drivers, Merz and Wilcox, had been eliminated. Merz drove a Peugeot and Wilcox a Premier.

Between the 75th and 100-mile mark various drivers tried to wrest the lead

from Resta by exceedingly clever driving and great bursts of speed. One of these was Louis Chevrolet, in a Frontenac, who brought prolonged cheers from the spectators, partly because of his exhibition and also because the car is an American made product. Aitken grimly hung onto second position, while D'Alene, who had developed an aston-

He passed D'Alene and several others in the front rank and snuggled into third position, where he waited for the break among the leading group that would allow him to shoot to the front and win the race.

It was on the 64th lap that the most serious accident of the afternoon occurred. While circling the south turn of the course, Jack LeCain lost control of his Delage and crashed into the retaining wall. The car overturned and LeCain sustained internal injuries and a broken back. The speedway management announced his injuries as "very serious." His mechanic, Bob Moore, escaped uninjured.

The second accident of the day occurred about the same time and in about the same manner. Tom Rooney, driving a Premier, crashed into the wall, suffering a broken hip. Thane Houser, his mechanic, was seriously injured.

In the 68th lap Aitken took another trip to the pits, and Resta took occasion to increase his lead to a safer margin. On the next lap Resta made his first and only visit to the pits, to change the right rear tire and fill his gasoline tank. His delay was one minute and four seconds, and yet he still retained the lead.

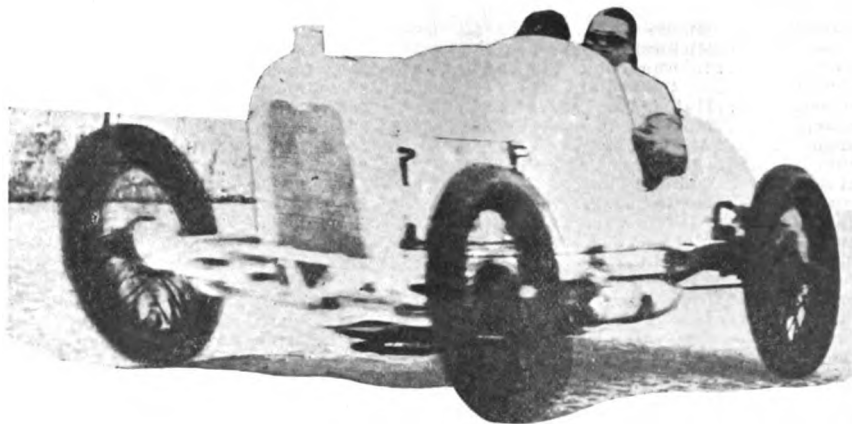
THE PRIZE WINNERS.

Driver	Car	Time	Prize
Resta, Peugeot.....		3:34:15	\$12,000
D'Alene, Duesenberg.....		3:36:15	6,000
Mulford, Peugeot.....		3:37:56	3,000
Christiaens, Sunbeam.....		3:46:36	2,000
Oldfield, Delage.....		3:47:19	1,700
Henderson*, Maxwell.....		3:49:56	1,400
Wilcox, Premier.....		3:54:31	1,200
Johnson, Crawford.....		4:01:55	1,000
Chandler, Crawford.....		4:03:11	900
Halbe, Osteweg.....		4:04:47	800

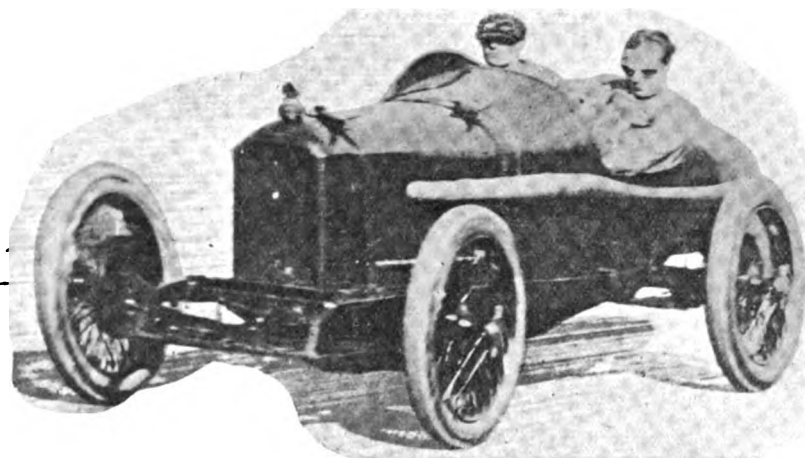
*Rickenbacher driving at finish.

ishing sprint, held third place. Back among the trailers was Mulford, who was gradually coming to the front.

In the laps between the 100 and 150-mile mark, Mulford took the curves in wonderful sweeps, daring where others were cautious and speeding up to the limit of capacity on the straightaways.



Rickenbacher, the Favorite, in the Maxwell Which Was Eliminated by a Broken Steering Knuckle.



Mulford in the Peugeot with Which He Captured Third Position After a Plucky Race.

In the next lap Aitken lost his chance for the winning position, through a broken valve that put him out of the race.

With 100 miles to go the race developed into a close fight for third position between Henderson and D'Alene. Resta had a comfortable lead and Mulford seemed to have clinched second place. But at the end of 250 miles D'Alene had pushed his car to the limit and outdistanced Mulford, who fell back to third position. Christiaens held fourth and Oldfield fifth. Behind them came Rickenbacher in sixth position, he having taken the wheel of the Maxwell driven by Henderson. Next in the order named was Haibe (Osteweg), Wilcox (Premier), Alley (Ogren) and Johnson (Crawford).

It was in this order that the race was finished, excepting that Wilcox crowded Haibe out of seventh and Chandler nosed in ahead of Alley for ninth place.

MERCER WINS AT HAVANA.

In the recent races at Havana, Cuba, a stock 22-72 Mercer raceabout won a

road race limited to cars of 300 to 450 cubic inches piston displacement. In the free-for-all event the same car came in second, the winning car being a 790 cubic inch Italia. The piston displacement of the Mercer is only 298.2 cubic inches, and the car had just been taken from the steamer and had but little time for tuning up.

NEW BROOKES' HAND BOOK.

The 1916 edition of Brookes' automobile hand book, a volume that has been recognized as an authority for several years, has just been issued. This edition, the sixth, contains an unusually wide range of information on all subjects pertaining to motor vehicles, and presents the latest available data on all systems now in use and consequently is very valuable to car owners, operators and repair men alike. About 400 of the 715 pages are devoted to 1916 equipment. In all there are 335 illustrations and 12 tables. Each subject is treated comprehensively and authoritatively, and all information is arranged so as to be instantly available to the reader. The

book is put out in pocket size and bound in flexible leather. It is published by Frederick J. Drake & Co., 1006 Michigan avenue, Chicago, and is priced at \$2, postpaid.

WORLD'S RECORD BROKEN.

It has developed that in the Western Inter-Club race at Chicago, May 21, the world's record for the fastest two miles ever travelled by an amateur driver in a motor car was broken by Dr. R. Robinson Duff. He drove a Rayfield, equipped stock Mercer in the 30-mile event, turning the two-mile course on one lap in 1:16 flat, or at a speed of 94 miles per hour. This remarkable performance has been officially authenticated and stands as the world's amateur record.

Charles L. Rayfield, designer of the Rayfield carburetor, acted as mechanic and advisor for Dr. Duff, his personal friend.

NEW PACKARD INFORMATION BOOK.

One of the best books of information concerning a motor car, its operation and proper care, that has ever appeared, is that which the Packard Motor Car Company, Detroit, has issued concerning the Packard Twin-Six, model 1-25 and 1-35. Every detail in connection with the cars is given careful and ample consideration and each is liberally indexed for ready reference. Aside from the large variety of information contained in the book, the motorist will find the photographic and plan illustrations exceedingly valuable and complete. The lubrication chart is arranged to afford the utmost convenience to the operator, it being printed in different colors to indicate those parts that require attention at different mileages. As an example, those components needing lubrication every 300 miles are so indicated by their names being printed in red ink. The text and illustrations are printed in two colors, red and black, which makes the book, together with its tasty gray board covers, a handsome volume.

OUTSTANDING FEATURES OF EQUIPMENT OF COMPETING CARS.

Car	Driver	Cyl.	Bore	Stroke	Displ.	Ignit.	Carb.	Plugs	Valves	Oil	Wheels	Tires	Wheel-base.
Duesenberg	D'Alene	4	3.9	6	299	Bosch	Miller	Rajah	8	Oilzum	Rudge	Silvertown	106
Maxwell	Henderson	4	3.75	6.75	298	Bosch	Miller	Rajah	16	Oilzum	Houk	Silvertown	106
Maxwell	Rickenbacher	4	3.75	6.75	298	Bosch	Miller	K. L. G.	16	Oilzum	Houk	Silvertown	106
Frontenac	L. Chevrolet	4	3.87	6.375	300	Bosch	Zenith	Rajah	16	Monogram	Rudge	Silvertown	104
Frontenac	A. Chevrolet	4	3.87	6.375	300	Bosch	Zenith	Rajah	16	Monogram	Rudge	Silvertown	104
Osteweg	Haibe	4	4.35	5	296	Bosch	Miller	Answer	16	Castor	Houk	Silvertown	102
Peugeot	Mulford	4	3.662	6.625	274	Bosch	Zenith	Rajah	16	Oilzum	Rudge	Silvertown	110
Ogren	Alley	4	3.989	6	299	Bosch	Miller	Rajah	8	Castor	Houk	Nassau	106
Sunbeam	Christiaens	6	3.213	6.25	299	Bosch	Miller*	Champion	24	Mixed	Rudge	Firestone	113
Delage	Oldfield	4	3.726	6.31	275	Bosch	Miller*	Rajah	16	Oilzum	Rudge	Firestone	104
Peugeot	Resta	4	3.655	6.6	274	Bosch	Miller	K. L. G.	16	Oilzum	Rudge	Silvertown	106
Peugeot	Aitken	4	3.655	6.6	274	Bosch	Zenith	K. L. G.	16	Oilzum	Rudge	Silvertown	100
Peugeot	Merz	4	3.655	6.6	274	Bosch	Zenith	K. L. G.	16	Oilzum	Rudge	Silvertown	106
Delage	LeCain	4	3.70	6.31	274	Bosch	Miller	.....	16	Castor	Rudge	Silvertown	106
Peusun	Franchi	4	3.706	6.31	299	Bosch	Miller	K. L. G.	16	Oilzum	Rudge	Silvertown	106
Crawford	Chandler	4	3.75	6.75	298	Bosch	Miller	Rajah	16	Oilzum	Rudge	Nassau	106
Crawford	Lewis	4	3.75	6.75	298	Bosch	Miller	Rajah	16	Oilzum	Rudge	Nassau	106
Crawford	Johnson	4	3.75	6.75	298	Bosch	Miller	Rajah	16	Oilzum	Houk	Nassau	106
Premier	Rooney	4	3.66	6.656	274	Bosch	Zenith	K. L. G.	16	Oilzum	Rudge	Silvertown	105
Premier	Anderson	4	3.66	6.656	274	Bosch	Zenith	K. L. G.	16	Oilzum	Rudge	Silvertown	105
Premier	Wilcox	4	3.66	6.656	274	Bosch	Zenith	K. L. G.	16	Oilzum	Rudge	Silvertown	105

*Two carburetors. All cars in the race were provided with Hartford shock absorbers, motometers and Dixon's graphite.



A NEW six-cylinder model, styled the "Hundred Point Six," has been designed by the Kissel Motor Car Company, Hartford, Wis., and the retail price set at \$1095. The name of the model refers to a hundred different features of construction which will be emphasized to the public.

The price of \$1095 applies only to the five-passenger touring car and the three-passenger roadster. On this chassis will also be mounted the KisselKar All-Year bodies, which are of a demountable type, providing an open car for summer and a closed type for winter. This type of body was originated by the Kissel company and has proved to be a great influence on the entire industry, through stimulating winter motoring.

The bodies to be mounted on the "Hundred Point Six" chassis will include combination touring-sedan, roadster-coupe and Victorian-town types. Prices and detailed specifications are expected to be announced later in the season.

The motor is made by the Kissel company and has six cylinders cast en bloc with the crank case. The bore is $3\frac{1}{4}$ inches and stroke five. The cylinders are of the L head shape and the motor is a high speed, high efficiency product with an S. A. E. rating of 25.4, but an actual brake horsepower of 52.

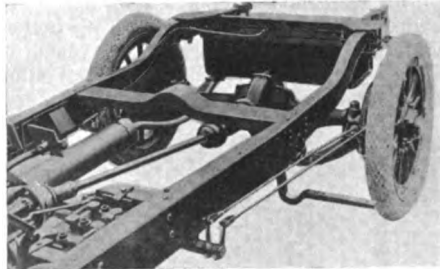
Valves are completely housed with openings of $1\frac{1}{2}$ inches in the clear. A special patented process is used in welding the heads to the stems so that all tendency to warp or bend is eliminated and the metal is rendered impervious to the chemical action of the gases.

The pistons are of an especially light annealed iron, which is submitted to rigid chemical tests and very accurately ground. Before assembling the pistons are balanced to less than half an ounce. There are two leakproof piston rings, which are of gray iron and considerably softer than the cylinders,

to avoid undue wear of the walls. The wristpins are $\frac{7}{8}$ inches in diameter. They are made of special hardened and ground steel and are pressed tightly into the piston and secured by a set screw and jam nut. The bushings are of non-gran bronze.

Crankshafts Carefully Tested.

The crankshaft is a forging made to specifications. It is double heat treated and rigidly tested for its elastic limit, ultimate strength, reduction of area, elong-



Rear Section of KisselKar Six, Showing 16-Gallon Gasoline Tank—Oil Bolts in Springs Replace Grease Cups.

ation, hardness and balance. The front bearing is $2\frac{1}{4}$ by $2\frac{1}{16}$ inches; the centre $2\frac{1}{4}$ by $2\frac{1}{2}$ inches and the rear $2\frac{1}{4}$ by three inches.

Cams, bearings and all parts of the camshaft are of a single piece from a hardened and ground steel drop forging, which is tested for accuracy in machining and by the scleroscope for hardness. Bearings on this shaft are amply large.

All bearings are made of Fahrigr bear-

ing metal. The bronze back is a composition of 95 per cent. copper. The upper half of the crank case is cast integral with the cylinders and the lower half is removable without disturbing the crankshaft assembly. A rigid stamping acts as an oil reservoir, as well as a cover for the crank case.

The connecting rods are of high-grade steel, heat treated with die cast Fahrigr bearings. One pressed fabroll gear working between two metal gears prevents wear and noise in the valve timing drive.

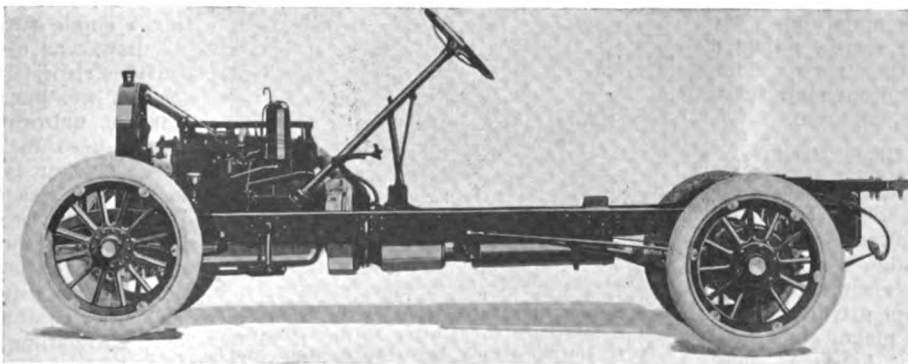
Water circulation is positive and is actuated by a large centrifugal pump. The stuffing boxes can be packed or the pump removed without interference. Lubrication is by a combination forced feed to the main crank shaft and splash to the connecting rods and piston. All oil is strained before it is redistributed. The number of grease cups has been reduced to two by substituting oil cups at all lubricating points except at the circulating pump.

The radiator is a special cellular honeycomb design with a detachable shell. It has an exceptionally large cooling surface. The fan is a pressed steel safety type that cannot cut the radiator.

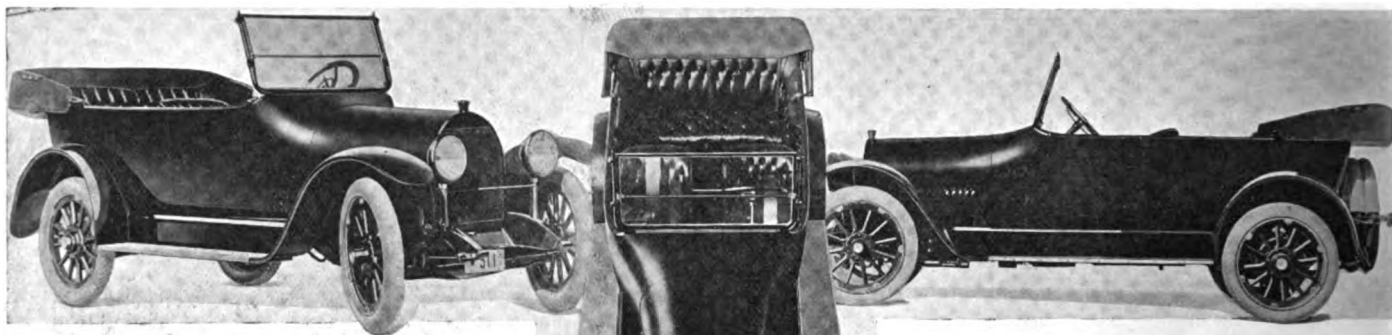
A new design of Kissel-Stromberg carburetor eliminates the necessity for using auxiliary air valves. It automatically produces the right mixture for either high or low speeds and so cuts down the waste due to the use of an over rich mixture at some speeds. It improves the starting and accelerating quality of

the car. The carburetor is mounted high and is directly attached to the cylinders, promoting accessibility and minimizing fuel waste.

Gasoline is fed to the carburetor by the Stewart vacuum system, the vacuum tank being attached to the cylinders near the carburetor. Remy ignition is employed. Electric-ity for charging the



Chassis of the KisselKar "Hundred Point Six," Having Wheelbase of 117 Inches.



Five-Passenger KisselKar Six, with Actual Brake Horsepower of 52—Price of This Model Complete Is \$1095.

storage battery from which the lights and starter are operated is provided by a Remy generator.

Special Kissel Starting Motor.

The starting motor is a special Kissel design, which has been used exclusively in KisselKars for four years in connection with the Bendix screw drive, an automatic device for engaging the starter with the flywheel gear. The storage battery is a Willard, the jar of which is tested by a 23,000-volt current to insure its ability to stand up against jolts and shocks. It is made with high quality lead grid alloyed with antimony.

The leather faced cone clutch has two adjustable fibre faced spring plungers, which act against the rim of the clutch when it is disengaged. The cone is a steel stamping, combining strength with the requisite lightness to minimize spinning and render gear shifting a smooth and easy operation.

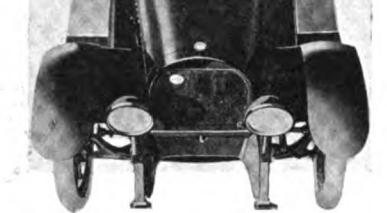
The same housing covers both transmission and clutch. The gearset is of the selective type with three forward speeds and one reverse. The main shaft is mounted on large annular ball bearings, and at other points there are phosphor bronze bearings which meet the S. A. E. specifications. The drop forged gears are of nickel steel. The levers and shifting yokes are very simple in design and practically trouble proof. A locking device is provided to prevent the engagement of more than one combination of gears at the same time. Every part is subjected to heat treatment and carefully checked by pyrometer.

There are two universal joints in the driving shaft between the transmission and the rear axle. The shaft is the best quality obtainable steel forging. The entire set can be removed without disturbing other parts.

The rear axles are of the full floating type with spiral bevel and pinion gears to insure quietness in operation. The pinion and driving gear can be adjusted without dismantling other parts. Timken bearings are used throughout. Drive shafts are of chrome nickel steel.

Hotchkiss Final Drive Used.

Final drive and torque go through the rear springs according to the Hotchkiss system. The differential case is made of a high grade of malleable iron with internal parts of .20 per cent. heat treated carbon steel and a bevel drive gear and pinion of 3½ per cent. nickel steel. All bearing surfaces are hardened and



View of Interior of Touring Car, Showing Corridor Between the Front Seats.

ground. Parts are standardized and interchangeable.

The brakes are double and are both external with 14-inch diameter and two-inch face. The brake drums are of one piece steel. The wheels are of the artillery type, made from the best grade of second growth hickory, and have 12 large spokes.

Demountable Rims Are Used.

The rear springs are three-quarter elliptic, 52 inches long and 2¼ inches wide. Semi-elliptic springs, 36 inches long and two inches wide are used in front. They are made of a special alloy steel and the rear springs are under-

This KisselKar Model Has Four Doors—All-Year Car Is Built with Three-Door Special Gibraltar Body.

slung to overcome sidesway and road shocks. Grease cups have been replaced by large bolts with oil reservoirs.

The frame members consist of channel iron, which is tested both chemically and physically on its arrival at the factory. Side rails are of high carbon strip steel. The side members are narrowed in front to permit a short turning radius. Wheelbase is 117 inches.

The steering gear is a semi-irreversible type with split nut and screw. Greater bearing surfaces than formerly and durability and facility of adjustment have been sought in designing this new gear. The steering wheel is 18 inches in diameter and is placed on the left side of the car.

Gasoline is carried in a tank at the rear of the frame and is held in place by two strongly riveted malleable metal brackets. It has capacity of 16 gallons. A gauge shows the exact quantity of the fuel in the tank at all times.

A Low Stream Line Body.

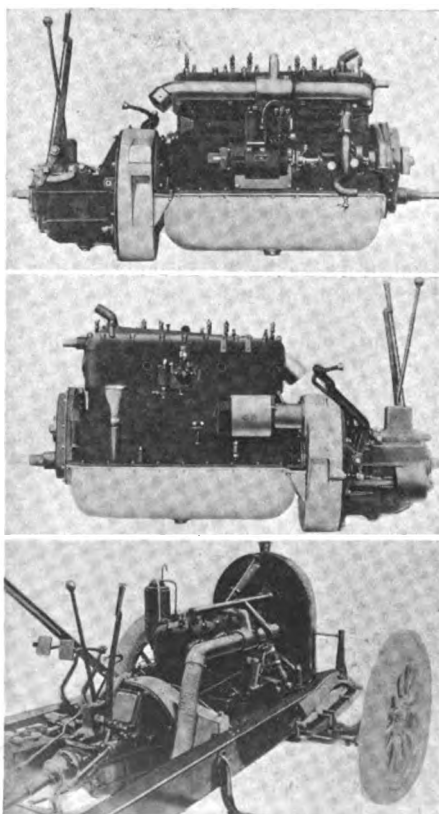
This chassis is provided with a low hanging stream line body of unusual depth, with curved moldings and blind doors and individual forward seats. The body skeleton is made of high grade ash covered with the finest available 20 gauge sheet metal of the best silver finish, insuring wearing quality and the best possible surface for finishing operations.

The upholstery is covered with a fine grade of oak tanned leather and has bindings and welts of double texture.

The instruments are mounted in a straight line on a cowl board of circassian walnut, so that they can all be seen readily at a glance. Concealed lamps provide illumination at night. All the wires of the electrical system are centralized on the front of the cowl so that trouble can be instantly located. It is possible to remove the body without cutting a single wire.

A new type of tilted windshield glass provides clear vision for the driver in all sorts of weather. The glass is polished plate of uniform thickness. It is the quality used in the production of mirrors. The top is a one-man type of the design that was originally introduced to America by Kissel. It is made of a fine quality of material and has the most approved type of accessories for attachment and operation.

The tire equipment is Goodyear, 32 by four, with all-weather non-skid tires at the rear.



The Kissel Six Motor, the Lower Illustration Showing the Entire Power Plant—Note Latest Remy Ignition System and Accessibility of Parts.



Acetylene gas is a highly explosive hydrocarbon when mixed with air, and the mixture when ignited produces a greater force than does gasoline similarly used. The proper proportions are said to be about 10 parts of air to one of acetylene. If a greater amount of acetylene be used the mixture is even more easily ignited than gasoline under the same conditions.

Some motors when cold are difficult to start. A suggestion to facilitate starting with acetylene is shown in Fig. 186. It consists of a small pet cock inserted in the top of the intake manifold. To the top of the pet cock is attached a piece of rubber hosing which is of sufficient length to reach the acetylene tank. To start the motor it is only necessary to open the cock on the top of the manifold, turn on a small volume of acetylene and then give the motor a few turns. The acetylene can be left turned on until the engine heats sufficiently to smoothly operate on gasoline. Either a generator or storage tank can be used for this purpose. It should also be remembered that should the gasoline supply become exhausted on the road, this acetylene primer can be used as long as the supply of acetylene lasts.

LOCATING MINUTE LEAKS.

Minute leaks, whether in the pressure type of fuel system, in inner tubes, exhaust manifold, spark plugs, valve caps, etc., are often difficult to locate with certainty. The usual method is to immerse the tube in water and note the direction from which the bubbles arise. A simpler plan is to make a soap and water solution and smear the tread. The smallest of leaks will be noted readily, as large

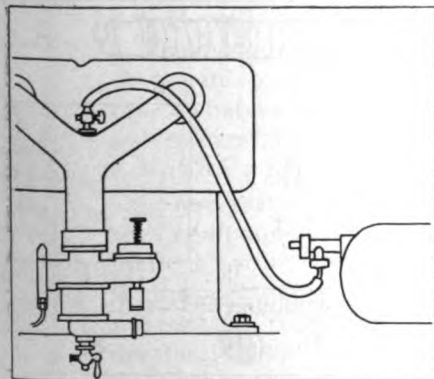


Fig. 186—Starting a Motor by Priming with Acetylene Gas.

bubbles will be produced. If a squirt can be filled with the same solution it can be used for testing the fit of spark plugs, valve caps, etc.

ALIGNING GAUGE.

To determine the alignment of the front wheels it is necessary to use some type of gauge. The one shown in Fig. 187 is especially handy when it is to be used on many machines of different makes. The centre or base piece is made from a piece of steel and bent as shown. The upright pieces are slotted so that the extended arms are adjustable to height. The arms are made of wood and are so attached to the base that the distance from end to end is about 56 inches, this being the standard tread. Each arm is slotted, however, so that

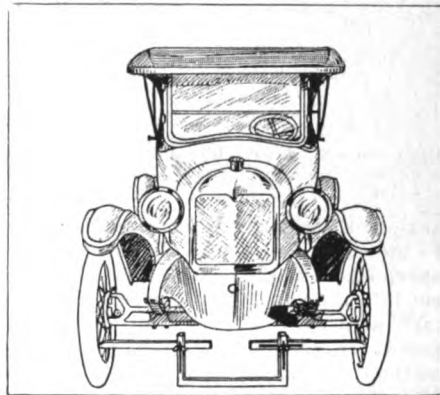


Fig. 187—An Aligning Gauge of Great Utility and How It Is Used.

the distance may be lessened or made greater as the case may require. The advantage of this type of gauge is that it is a time saver. Its use eliminates the necessity of marking the wheel felloes. It is only necessary to place the flat base on the floor and set the height at the front of the wheels and it will be the same at the back.

CRACKED WATER JACKETS.

Though the best repair possible for a cracked water jacket is to have it welded by the autogenous method, the following has frequently been used successfully. With a three-corner file open the crack in the jacket to a V shape without increasing the opening on the inner side.

Smooth the edges and deposit on them any of the preparations which are sold for silver plating. The material will readily adhere to the smooth surfaces and if the pressure is not too great, the repair will endure indefinitely.

TO NEUTRALIZE BATTERY ACID.

A certain percentage of sulphuric acid is used in making electrolyte for a storage battery. When handling sulphuric acid a little of this fluid spilled on the operator's clothes or the fittings of the car will quickly cause holes to appear. To neutralize the effect of the acid, there is nothing better than strong ammonia when applied promptly. Ammonia mixed with vaseline forms a good preventive of corrosion when rubbed on battery terminals.

HANDY COMPARTMENTS.

When making repairs on a car it is poor practise to place parts which have been removed from the machine on the running board or set them at random on the bench. It is much better to have some small metal retainer which cannot easily be tipped over. Three ordinary bread pans fastened together serve this purpose well. As shown in Fig. 188, the three are connected by two pieces of thin sheet metal, and each is fastened to the strip by two rivets. The arrangement is extremely handy, as besides being used to store detached parts, it may be utilized to hold gasoline or kerosene for cleaning parts of the machine.

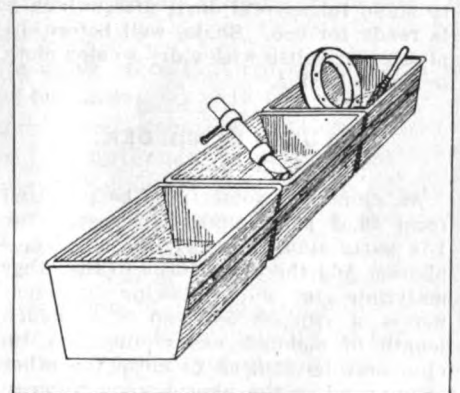


Fig. 188—Home-Made Parts Holder for Use While Repairing or Overhauling Car.

WEAK VALVE SPRINGS.

Frequently it is difficult to locate the cause of missing at low engine speeds. There are several probable causes for

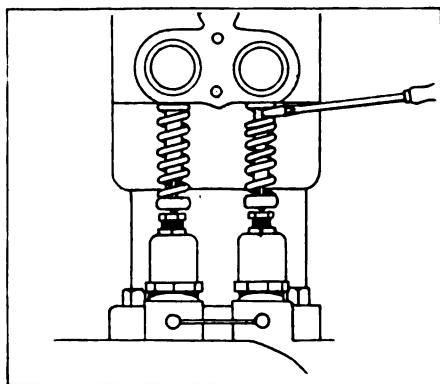


Fig. 189—Testing Valve Springs for Weakened Condition.

this condition, such as leakage of air in the intake pipe connections, valve stem guides, weak ignition, spark plug electrodes not properly adjusted, poor mixture, etc., but if after making all these tests and the trouble cannot be located, it is advisable to examine the exhaust valve springs to determine that they have not lost their tension.

Should an exhaust valve spring be weak it will not seat the valve at low engine speeds, resulting in irregular operation. To test the action of a valve spring, insert the blade of a screw driver between the coils as shown in Fig. 189. This should be done while the motor is operating. If the missing stops when the blade is inserted between the coils it will indicate that the spring has lost its tension, and either a new one should be fitted or the old one stretched if possible.

The reason for missing in a cylinder which has a weak exhaust valve spring is that when the throttle is closed the suction created by the piston has a tendency to raise the valve from its seat, thus drawing in some of the exhaust gases.

BRASS POLISH.

A suitable polish for brass parts can be made of three ounces of powdered rotted stone, two ounces of pumice stone, four ounces of oxalic acid and two quarts of rain water. Mix thoroughly and allow to stand for several days, after which it is ready for use. Shake well before applying and polish with a dry woolen cloth or chamois skin.

ALUMINUM SOLDER.

An aluminum solder may be prepared from 50.03 parts zinc, 47.99 parts tin, 1.76 parts aluminum and .22 parts phosphorus. Add the phosphorus to the other materials in the following manner: Screw a cap on one end of a 12-inch length of one-inch gas piping. A tin plug may be utilized to close the other opening. Dry the phosphorus between blotting paper and expose to the air as little as possible. Remove the cap from

the piping, insert the phosphorus and replace the cap. The tinned end of the pipe is next placed into molten tin, the heat of which will be sufficient to melt the plug and allow the phosphorus to mix without danger to the operator. Next add the required quantity of zinc and aluminum. The phosphorus serves as a flux and consequently no sal ammoniac or spirits are required when making a joint. An ordinary soldering copper can be used.

CLINCHER TIRE REMOVER.

The majority of motorists experience difficulty when attempting to pry the clincher shoe away from the rim so that the tire tool can be inserted. There are several devices now on the market for facilitating the removal of this type of shoe, but if the motorist does not feel disposed to expend the necessary amount, a tool similar to the one shown in Fig. 190 can easily be made. It is made of one-inch square steel. The construction consists of two tong like extremities having handles, which, when brought together, overcomes the resist-

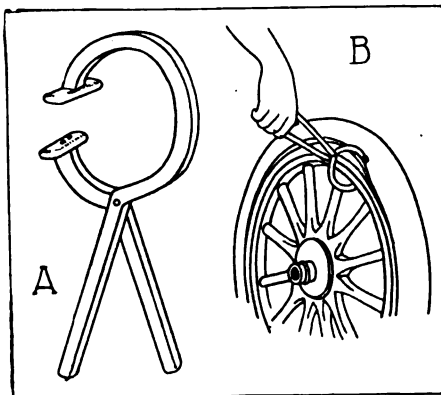


Fig. 190—A Simple but Practical Clincher Tire Remover, and How It Can Be Used.

ance of the shoe even when badly rusted to the rim. Be sure to round off all the sharp edges of the tool so that it will not cut into the shoe. The pieces which contact with the tires are attached with screws to the end of the jaws. The method of application to the tire is shown in Fig. 190 B.

LEATHER AND IRON CEMENT.

To face a cast iron pulley with leather, apply acetic acid to the pulley with a brush. The action of the acid roughens the surface by rusting. When dry apply a cement composed of one pound fish glue and half pound common glue, melted in a mixture of alcohol and water. Place the leather on the pulley and dry under pressure.

MILLING CUTTER LUBRICANT.

An excellent lubricant for milling cutters can be made by mixing together and boiling for about a half hour one-quarter pound sal soda, one-half pint lard oil, one-half pint soft soap and enough water to make 10 quarts.

CLEANING THE HANDS.

A repair man in Massachusetts advises that the appearance of a mechanic's hands can be much improved by cleaning them in the following manner: Rub ordinary soap well into the pores of the skin and with the aid of a little gasoline, form a lather by rubbing the hands together. The hands can then be washed in the ordinary manner. A brush with stiff bristles will greatly aid the cleansing operation.

BODY POLISH.

A good and inexpensive polish for brightening enameled body parts can be made by mixing three ounces of citronella, one pint of kerosene, one gallon of turpentine and 1½ ounces of oil of cedar. Apply the mixture with a soft cloth and then rub well with another dry soft cloth. The more rubbing afforded the parts the greater will be the lustre.

GRINDING ALUMINUM.

If an aluminum casting is ground on an ordinary emery wheel, the soft metal is apt to clog the abrasive material and impair its cutting efficiency. To avoid this condition, apply paraffine wax to the cutting surface of the wheel. This material will not effect its efficiency and can easily be removed when desired by applying heat.

GASOLINE PIPE REPAIR.

In a peculiar accident that recently happened to an automobile, the gasoline pipe leading from the storage tank to the carburetor was kinked and cracked. A repair man was summoned and after making repairs to the engine, fixed the gasoline pipe as illustrated in Fig. 191. With a hacksaw the kinked section was cut out. Next he removed the rubber tubing from one of the front headlights and slipped it over the ends of the metal pipe. Because of vibration, chafing was apt to cut the rubber and so the pipe was placed in splints as shown. The splints were held in place by wrapping the pipe with tape and then reinforcing with twine. The repair proved very satisfactory.

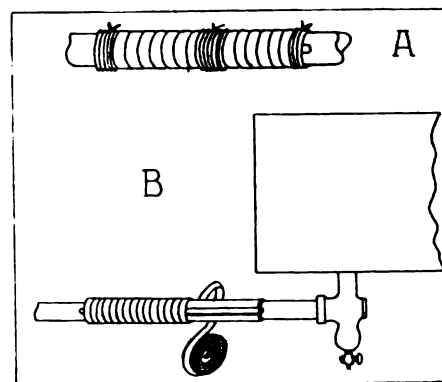


Fig. 191—An Emergency Repair of Gasoline Line That Proved Serviceable.

SUGGESTIONS FOR THE FORD CAR OWNER.

Determining the Condition and the Needs for Restoration of the Cylinders and Pistons, and the Removal and Replacement of the Wristpin Bushings and Rings.

The 49th article dealing with the operation, construction, maintenance, care and repair of the model T Ford chassis is the 10th of the series devoted to adjusting, restoration and overhauling.

GRINDING the bearings is a work that requires care. The main requirement is that the valve should seat equally all over the edge of the port. When the ports and valves are examined after considerable service one may find that both are "pitted," that is, there are minute holes in the surfaces, which are the result of erosion by the heated gases. Or there may be accumulations of "carbon," the products of combustion that have become consolidated by the constant action of the valves upon the seats.

The ideal condition of a valve is what is known as a "glass finish," the faces of the valves and the ports being polished, as well as being perfectly seated. The expert mechanic will by grinding cut away only sufficient metal from the port faces to obtain the exact seats for the valves, and when this has been accomplished the polishing is done by the use of a finer grade of grinding compound.

Polishing the valve and seat is a matter of patience and a fine grinding material. Many repairers will maintain that polishing is unnecessary, that the labor necessary must be paid for and costs money, and satisfactory operation can be obtained when the surfaces are clean and smooth and the valve is perfectly seated.

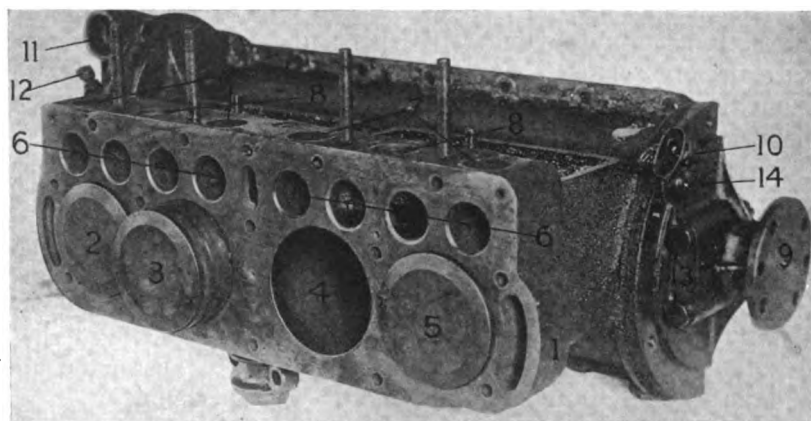
The owner who does not know that a polished valve will better resist "pitting" and will maintain compression for a much longer period will probably regard the cheaper job as being sufficient for all requirements, but the man who is doing his own work can take whatever time is necessary to finish the valves carefully, for he will find they will be efficient for a much longer period.

The seat will wear much faster from the compound than the valve, for the former is soft and the latter is hard, and if the seat is necessarily reduced this may necessitate "retining" the valves. One must understand that the movement of the valves is governed by the camshaft, and all valves should

open and close with precise relation to each other. If one valve seat is cut lower than the others this valve will be lower in its relation to the tappets or push rods than the other valves, and it will be opened and will close earlier than the other valves, which will obviously influence the firing of the engine.

Reseating Valve Ports.

The condition of the valve ports may be such that "reseating" is necessary, that is, the metal must be cut away, and this cutting must be evenly done so that the valves will have the designed relationship to each other. The slight change made by grinding is not sufficient to vary the timing to such an extent that the firing is affected, but "reseating" requires a heavier cut of the metal. This work can be done by the owner provided that he uses extreme care, but as a rule

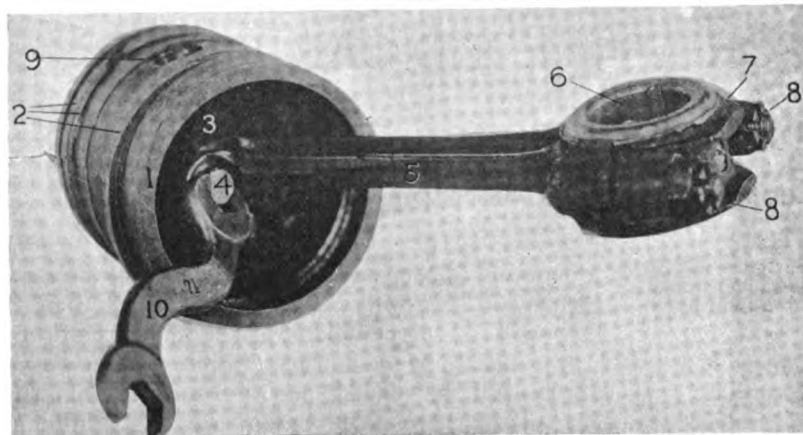


Ford Engine Block on Side, Showing Piston Partly Withdrawn.

- | | |
|----------------------------------|------------------------------|
| 1—Engine Block. | 8—Intake Ports. |
| 2—No. 1 Piston Head. | 9—Crankshaft Flange. |
| 3—No. 2 Piston Partly Withdrawn. | 10—Oil Tube. |
| 4—No. 3 Cylinder. | 11—Breather. |
| 5—No. 4 Piston Head. | 12—Fan Adjusting Screw. |
| 6—Valve Ports. | 13—Crankshaft Bearing Bolts. |
| 7—Exhaust Ports. | 14—Rear End of Camshaft. |

reseating had best be done by a thoroughly experienced mechanic.

The end of the valve stem that contacts with the tappet may be worn, so that the stem is somewhat shortened and some may maintain that the stem can be lengthened by peening that part of it that extends below the valve guide, but this is not a work that an owner should undertake. Putting in a new valve is an absolutely certain restoration and will be much more satisfactory, for the operation of the engine will be accurate. There is very little probability of the camshaft cams or the tappet rods being materially changed by wear, this statement having



Ford Piston and Connecting Rod Assembly. Showing Wristpin Clamping Bolt.

- | | |
|---------------------------|-----------------------------|
| 1—Piston. | 6—Connecting Rod Bearing. |
| 2—Piston Rings. | 7—Connecting Rod Cap. |
| 3—Piston Wristpin. | 8—Connecting Rod Cap Bolts. |
| 4—Wristpin Clamping Bolt. | 9—Wristpin Bushing. |
| 5—Connecting Rod. | 10—Small S Wrench. |

reference to length of the rods and the lift of the cams.

Removing Pistons from Cylinders.

When the crankshaft and the camshaft have been removed from the engine block the pistons can be withdrawn from the cylinders and the valve tappets taken from the guides.

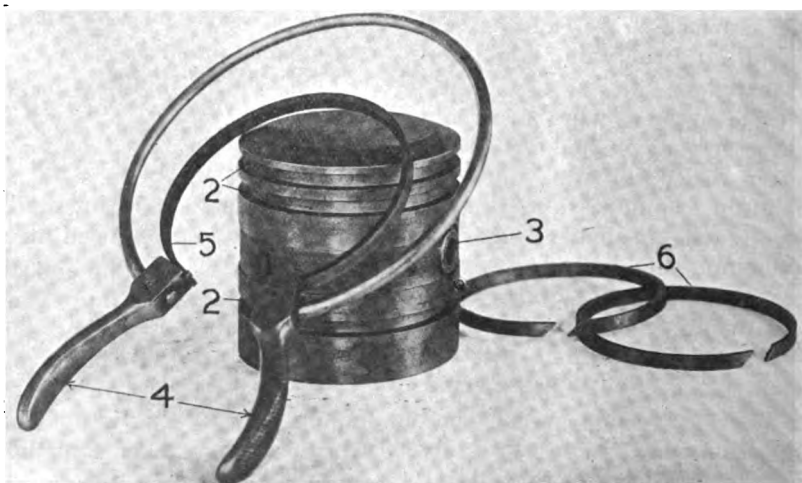
The pistons may be taken from the tops or the bottoms of the cylinders, if the connecting rod caps are removed, but must be drawn out from the bottom if the caps are in place. The pistons and the cylinders should be wiped clean of oil and then they can be examined. There are three rings fitted to each piston, two of which are above the wristpin and one in the skirt or lower portion, below the wristpin. These rings are machined from cast iron, are eccentric in form and are diagonally split in the thinnest section. This statement applies to rings that are fitted at the Ford factory, but piston rings are made in so many different ways that description of the differing types cannot be attempted.

The piston rings are carried in three rectangular channels in which they are accurately fitted. The rings are ground on the edges and face and though there should be freedom of movement for expansion and contraction of the rings, there should be no play vertically in the channels. The rings are slightly contracted in the cylinder so that when the pistons are withdrawn the rings will expand and there will be considerable space between the ends where they are diagonally cut. When on the pistons in the cylinders the ends of the rings are much nearer together.

When the cylinders are cleaned they should be examined to learn whether or not they have been scratched or "scored" by an abrasive or by an object carried by either the pistons or rings. There are instances of where a loose wristpin has cut the cylinder considerably, to such an extent that reboring and a new piston were necessary to obtain normal service. If the rings are contacting perfectly they will be uniformly bright for the entire circumference, but if they should be blackened or discolored in any place or places, this is an indication of leakage. Assumedly the cylinder is in good condition logically effective restoration can

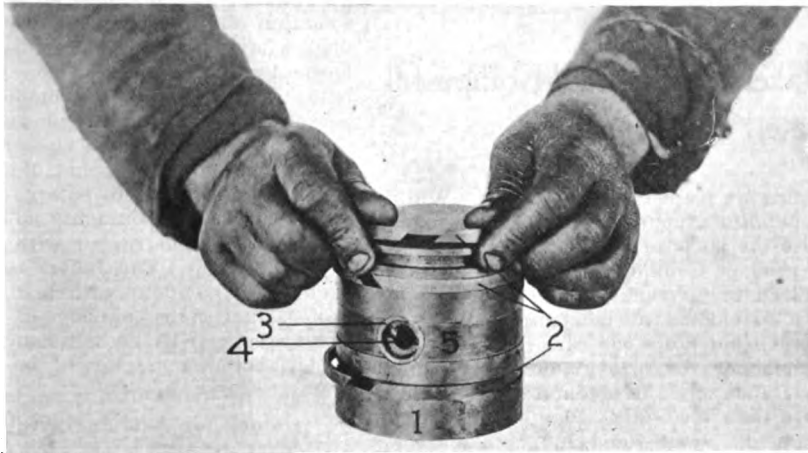
be obtained by fitting new rings. One is not justified in attempting to continue the use of a defective ring. Much better and more certain efficiency can be obtained with new rings and but little can be done with a leaky ring, even by an expert. A ring may fail because it has lost elasticity and will not always conform to the variance in the cylinder dimension. If the cylinder has been worn so that it is not round there may be a leak past the ring and the ring be in good condition. One can judge this from the appearance of the cylinder. One may expect to find more or less carbon in the ring channels.

After the pistons have been removed from the cylinders the connecting rods should be taken off. This is done by backing out the clamping bolts in the small ends, which can be reached with an S wrench. When the bolts have been removed the wristpins can be driven out of the piston bushings and the connecting rod small ends.



Expander for Removing or Putting on Piston Rings.

- | | |
|-------------------------|-------------------------|
| 1—Piston. | 4—Piston Ring Expander. |
| 2—Piston Ring Channels. | 5—Piston Ring Expanded. |
| 3—Wristpin. | 6—Piston Rings. |



Putting on Piston Rings Without Special Tools.

- | | |
|---------------------|---------------------------------|
| 1—Piston. | 4—Wristpin. |
| 2—Piston Rings. | 5—Wide Oil Groove or Clearance. |
| 3—Wristpin Bushing. | |

The rings are removed from the channels by expanding them, lifting the split ends with a screw driver or similar small tool and sliding three small pieces of flat metal, thin steel or brass, under them at different points until they clear the edges of the channels. The lower ring may be removed first and then the lower of the two upper rings, for this ring can be expanded sufficiently to pass it over the top ring. Taking out the top ring is a comparatively easy work, for after it has been lifted to clear the channel edge it can be slipped off. When one has a ring expander the work is done very quickly and easily. A ring expander, such as is shown in the accompanying illustrations, is made of a piece of spring steel that is formed practically into a ring somewhat larger than a piston ring.

To the ends of this two handles are fitted, by which the ends may be drawn together by the pressure of one hand. In the upper ends of the handles are two studs, which can be placed in the split in the ring. The ends of the handles at either side of the studs are formed with rectangular notches, with the studs in the centres. When the ring is normally expanded in the channel it can be pressed from the side opposite the split, so that the ends will project beyond the edges. The points of the ring ends are engaged between the studs and the walls of the notches in the handles of the expander, so that the ring can be expanded further by the force of the expander spring when the handles are released, and the ring can be lifted off, as is shown in the illustration.

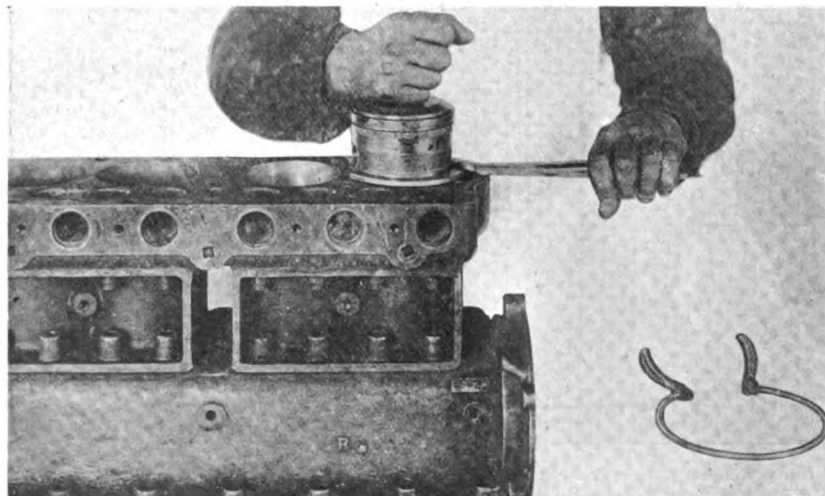
Should a ring be broken there is possibility that it has scored the cylinder walls, and

while there is probability that grinding the cylinder, which is a shop job, may be sufficient restoration, reboring may be necessary. This can only be done with special equipment and then the cylinder should be lapped and polished. When reboring is done an over size piston and new rings is necessary.

The piston channels should be cleaned perfectly and the rings wiped thoroughly. Replacing the rings is practically a reversal of the process of removal, but they can be usually expanded sufficiently with the fingers to slip them on, the upper and lower rings first, and then the third or middle rings

can be passed over either of the others. Care should be taken, however, for the edges of the rings may be knife-like and a painful cut may result. The bushings of the wristpins can be tried by feeling, and if there is any play new bushings should be installed. Removing the old bushings and putting in the new is a comparatively simple work. In replacing the wristpins care should be taken to have the clamping bolts tightly set and the nuts locked. Because the clamping bolts fit in the grooves of the wristpins there can be no error of adjustment with these. In replacing the pistons in the cylinders the rings can be contracted with pieces of stout cord, wire, or better still, a tongs can be used that can be made of flat metal stock and have semi-circular jaws sufficiently large to encircle a piston tightly. With this tool the rings can be compressed easily and quickly and slipped into the cylinders. Because of the saving in time and labor such a tool is very desirable, even in the private garage, where it is used infrequently.

(To Be Continued.)



Putting Piston in Cylinder with a Ring Clamp, a Type of Tongs Designed Specially for This Work.

INDUSTRIAL NOTES AND COMMENT.

Recent Happenings Among the Makers of Cars and Equipment and Members of Related Industries.

Tentative plans are being made by the Inter-State Motor Company, Muncie, Ind., to build a new addition to its plant this summer, it to be 800 feet long, 50 feet wide and two stories high. This will provide approximately 350,000 square feet of floor space. This company recently installed two large enameling ovens where such parts as fenders, dust skirts, hoods and other small parts are enameled and baked by natural gas, which is obtained through the local gas company from West Virginia.

Gilmer Branch at Detroit.

The L. H. Gilmer Company, Philadelphia, maker of Gilmer endless belts, is preparing to open a factory branch in Detroit, in order that its customers may have direct service from the plant. The service arrangements with the R. B. Ridgley Company, which have been in existence for a number of years, have been terminated.

Promotions in Fuller Company.

Fuller & Sons Manufacturing Company, Kalamazoo, Mich., automobile parts builder, announces that P. H. Oggel has taken charge of its purchasing department and also that G. W. Fuller is now connected with the sales department. This company recently erected two new buildings and is now running day and night and expects to continue the working schedule throughout the balance of the year.

Studebaker Still Expanding.

The Studebaker Corporation recently purchased 68,000 square feet of land ad-

joining its plant No. 3 in Detroit. While no definite announcement has been made as to the purpose for which the plat will be used, it is understood that it will be utilized to increase manufacturing facilities to enable the company to produce the scheduled 100,000 cars in 1916. The Studebaker factories now cover more than 150 acres of ground and employ more than 7000 men. Plants are located in Detroit, South Bend, Ind., and Walkerville, Ont., Canada.

Allen Makes Rapid Progress.

Among the automobile companies that are helping to make the motor car industry the most phenomenal development in history is the Allen Motor Company, Fostoria, O. This company reports that during the past year it has shown an increase of 300 per cent. in the number of dealers handling the Allen popular priced cars.

Chalmers Offers Training.

Hugh Chalmers, on behalf of the Chalmers Motors Company, Detroit, of which he is president, offered to pay the full salaries of the first 50 employees to enroll for the summer training camps held under the auspices of the government at Plattsburg and Fort Benjamin Harrison. In a speech announcing the proposal Mr. Chalmers took occasion to state that he was heartily in favor of universal military service for every American youth, "because it is the best possible training for the strenuous civil life of today."

Recreation for Jeffery's Men.

The Thomas B. Jeffery Company, Ke-

nosha, Wis., is encouraging and helping its employees to organize an athletic association and construct a \$4000 baseball field, a large share of the expense being borne by the company. The park will be 500 feet square and accommodate 700 persons in the grandstand and 300 in each of two bleachers. The grandstand will be "sectional," so that units can be added in the future to enlarge the seating capacity. A thoroughly modern club house will be constructed, with all necessary equipment. The Jeffery team is expected to compete with leading semi-professional clubs outside of Chicago. Tennis courts, basketball courts and a cinder running track will be installed later.

Stock for A C Spark Plugs.

Foreseeing a shortage of raw material, Albert Champion, president of the Champion Ignition Company, Flint, Mich., placed very large orders for steel, copper and other materials during the first months of the European war. Consequently, the company now has many tons of raw material in its vaults beneath the factory buildings. This enables the company, which is said to be the only one in its field to manufacture every part put into a spark plug, to meet the enormously increased demand for its product. More than 60 manufacturers are now equipping their motors with this type of spark plug.

Ford Tractors in Russia.

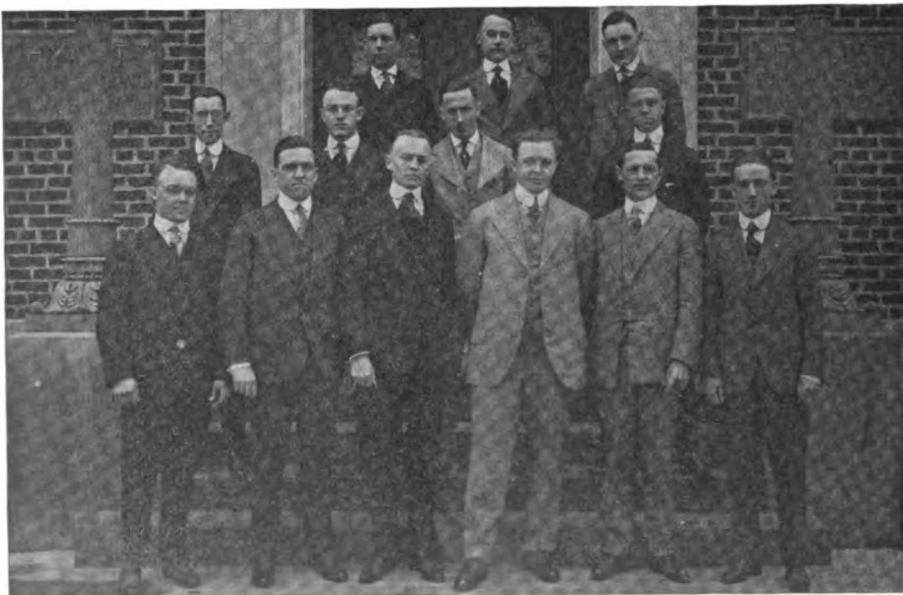
The Ford company is preparing to locate selling stations for Ford tractors in Russia, Gaston Plaintiff, who represents Henry Ford in many ways, having sailed from New York recently to take charge of the business in the Czar's empire. No details have been given out for publication.

Dixon Window Display Week.

During the week June 3-10 automobile dealers in all parts of the country have been taking part in a national "Dixon Week," decorating their windows with Dixon automobile lubricants and trimming them with material supplied by the Joseph Dixon Crucible Company. Prominent in all windows were photographs of the leading racing drivers, which were supplied by the Dixon company. Early reports indicate a tremendous business done by dealers handling these well known products.

Hyatt Service Convention.

The first annual convention of Hyatt service managers, held at the Detroit office of the Hyatt Roller Bearing Company, was attended by men from every city in the country which has a Hyatt service station. The meeting lasted for three days, during which there were talks by A. K. Hebner, service supervisor; Horace A. Brown, Jr., of the engineering sales department; W. E. Biggers, advertising manager; K. K. Hoagg of the engineering experimental department, Henry T. Ewald, C. M. Eason of Chicago, manager of the tractor bearings department; G. B. Koether, general sales manager, and R. S. Lane, chief engineer. On the last day the visitors inspected



Annual Convention of Hyatt Service Managers—Reading Left to Right, Top Row: A. W. Robbins, Seattle; N. S. Swan, Minneapolis; J. W. Taylor, Detroit; Middle Row: J. W. Hutchinson, Boston; H. Jay, San Francisco; K. H. MacQueen, Newark; R. B. Campbell, Atlanta; Bottom Row: R. C. Brower, Traveling Supervisor, Detroit; J. J. Hanrahan, Los Angeles; L. R. Remington, Chicago; R. S. Lane, Chief Engineer, Detroit; B. G. Koether, General Sales Manager, Detroit; A. K. Hebner, Service Supervisor, Detroit.

the new Hyatt warehouse. The visiting managers are shown in the accompanying illustration.

Chase Does Big Business.

M. F. Chase, New England representative for the Owen Magnetic car, during the first six months in this position has done about \$450,000 worth of business, having sent specifications to the factory for 93 machines. Because of the increased business, which is attributed not only to the excellent Chase organization, but also to the advanced form of transmission of the Owen Magnetic car, Mr. Chase has been forced to lease 20,000 square feet of floor space in a new building going up on St. Mary's street, Boston, which will be used as a service station.

Packard Issues Mexican Map.

To enable those interested to follow the reports concerning the operations of the American army in Mexico, the Packard Motor Car Company has issued a very good map of the border country, showing the various points mentioned in the reports and the distances between them. A short review of the Mexican situation is given, as is the state of preparedness of the company which enabled it to ship a large number of trucks with trained crews in 22 hours after the order was received from the government.

Olds Increases Schedule.

The production of Oldsmobiles, already well beyond the 10,000 mark per annum, is to be raised to 20,000 cars next season, according to an announcement made by the Olds Motor Works after a careful canvass of the demand for its product.

"Olds production plans," said Jay V. Hall, associate executive of the Olds company, "are gauged for next year on the sound assumption that care in the selection of a car will increase rather than diminish. Our present data is to the effect that we shall move 20,000 cars without difficulty."

Hudson Prices Are Increased.

Increasing material costs have forced the Hudson Motor Car Company to add \$100 to the prices of its open cars, while \$250 has been added to the price of two closed car models. The touring car and roadster, which were formerly \$1375, are now \$1475. The sedan, formerly \$1900, is now \$2000; the cabriolet, formerly \$1675, is now \$1775, and the limousine and brougham, formerly \$2500, are now \$2750.

FABRIKOID ON MANY CARS.

That 75 per cent. of the motor cars to be sold during 1916 will be priced at \$1000 and less, and that 60 per cent. of these will be upholstered in Fabrikoid is the statement made by the Du Pont Fabrikoid Company, Wilmington, Del., the maker of Motor Quality Fabrikoid. This would seem to indicate that the industry is turning more to this material every year, in preference to the cheap split leathers formerly used. Fabrikoid has been used for several years and has had a very severe test on thousands of cars.

MAKING "SYNTHETIC GASOLINE.

Three Men Have Laid Claims to Production of Chemicals to Convert Water Into Motor Fuel.

Among the several claims to discovery of chemicals by which water can be metamorphised into a liquid that will fill all the requirements of gasoline in propelling motor vehicles, three have appeared in the public prints within the past few weeks. The names by which they are known to the inventors thereof are "motorzine," "gasof foam" and "motor-gas."

"Motorzine" is the invention of two men of St. Louis, William H. Stevens and Charles Hofmeister, who claim that it is fully as efficient as gasoline and exceedingly more economical. The claims have interested experts in the government's bureau of mines and a resolution has been introduced in the House of Representatives to have the liquid investigated.

The inventors claim for "motorzine" that there is no loss by evaporation or leakage, as there is with gasoline, and that it can be made of materials too generally available to be monopolized.

"Gasof foam," the invention of Henry T. Caultlet of Trenton, N. J., was recently subjected to a test before a group of prominent city officials. In this test the tank of a Mercer car was emptied of its gasoline contents and "gasof foam," a thick, pasty substance, was poured in. Then followed a run of about 20 miles, the motor functioning perfectly, it is said, and the consumption being only one quart and a gill. For a run of this distance with gasoline more than a gallon would have been used. This economy for "gasof foam" and the fact that the inventor claims it can be produced at a cost of approximately 12 cents a gallon,

is creating a sensation among New Jersey motorists.

Mr. Caultlet has not divulged his formula, beyond saying that he has been at work upon it for about four years and that it is made of inferior oils "subjected to agitation." In his opinion the ratio of economy in favor of his product is two to one over gasoline.

Daniel E. Smith of Stoneham, Mass., has been meeting the fate of the majority of inventors in trying to introduce his "synthetic gasoline," which he calls "motor-gas." The newspapers have been inclined to ridicule his claims, but in spite of that he has given several demonstrations, one of the most recent of which was held before a crowd of 400 of his fellow citizens. Loading a large automobile with eight passengers, Mr. Smith poured in his chemical mixed with water and started the motor. That the car went only 600 yards is attributed by the inventor to the fact that only one-half quart of motor gas was used, which in his opinion is not sufficient for the load carried.

In another test he ran a car with five passengers for about two miles at an average of 25 miles an hour. The inventor claims the chemical can be made so cheaply that a gallon of fuel would cost about three cents. The formula is being held as a secret, though it is understood that the chemicals used are simple, are of American manufacture and can be obtained anywhere. To "manufacture" five gallons of fuel it is only necessary to fill the tank with that amount of plain water and then add six ounces of motor-gas.

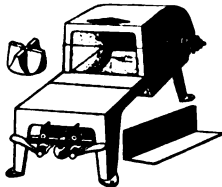


An Attraction at the Indianapolis Race Was the National Motor Vehicle Company's Band, Shown in Illustration, Which is Made up Entirely of Factory Employees.

SELECTED EQUIPMENT FOR PRIVATE GARAGES.

BENCH FURNACE.

Johnson's No. 101 bench furnace may be used for case hardening, annealing, heating for tempering, heating soldering



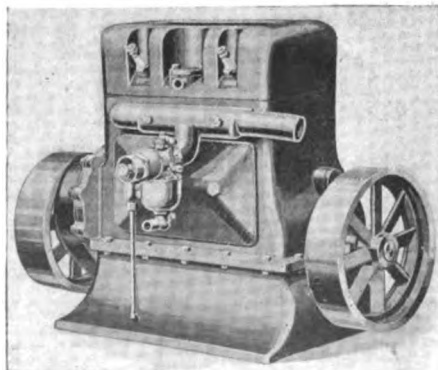
coppers, capping steels and for similar purposes. It is equipped with two powerful auto blast burners, which have a gas consumption of only 12 to 30 cubic feet per hour. The removable work rest block shown in the illustration when placed in the combustion chamber allows the flame to completely envelop and evenly heat the work placed upon it. There is also a baffle plate, which, when used to partially close the mouth of the furnace, insures an even temperature in the combustion chamber.

Manufactured by the Johnson Gas Appliance Company, Cedar Rapids, Ia. List price, \$10.

AUTO ENGINE COMPRESSOR.

Illustrated herewith is an auto engine compressor which combines all the functions of an efficient air compressor with those of a gasoline motor for light power purposes. Its cardinal feature is compactness, the compressor, power plant, driving pulley, ignition and fuel supply being incorporated in the unit. It is ideal equipment for the repair shop, machine shop, small factory, farmer and private and public garage.

There are three cylinders set in line and cast in one block. The two end cylinders furnish the motive power by the four-cycle principle, while the centre member supplies the air. When required as a power plant only, the compressor cylinder is released by simply turning a lever. The outfit then operates like any conventional gasoline motor and transmits its power by belt to any machinery that can be run by three horsepower or less. The motor is of the L head type with poppet valves. It has a



bore of two inches and a three-inch stroke. The air compressor cylinder is of the same dimensions.

The crank case is divided on a line with the crankshaft, the upper half being integral with the cylinders. The lower half is separated into two distinct compartments and retain the lubricating oil and fuel. These compartments are cast with the case, thus obviating any possibility of leakage from one into the other. The air pressure from the compressor elevates the fuel to the carburetor, affording a positive feed.

The exhaust and intake valves of the motor and the intake valve of the compressor cylinder are interchangeable and are operated by a single camshaft. The compressor exhaust valve is automatic and of unusual pattern. It consists of a single disc of alloy steel, so designed that the full port opening is secured with a lift of less than .02 of an inch.

By the S. A. E. formula this motor has a rating of 3.2 horsepower. It is de-

On this and the following pages will be found non-technical editorial descriptions and illustrations of a selected line of equipment and tools that are either adaptable to or especially designed for private garages, whether they are new or old. Many of these are essential to such a garage's equipment, while all are desirable if the motorist is to obtain the highest degree of service from his car's home, when writing to the manufacturer or distributor mentioned in each description, kindly mention *The Automobile Journal*.

signed to run at a normal speed of 1200 revolutions per minute, and at this rate pumps $6\frac{1}{2}$ cubic feet of air a minute. Statement is made that the compressor is capable of obtaining a maximum pressure of 300 pounds to the square inch.

Ignition is by a high-tension magneto coupled compactly to the motor, while lubrication is by the splash system. Bearings are of die cast nickel babbitt. The motor is water cooled, having a capacity of $1\frac{1}{2}$ gallons in the jacket surrounding the cylinders. A water intake extending upward in the form of a reservoir makes filling convenient and simple. The complete weight of the outfit is approximately 100 pounds.

Manufactured by the Auto Compressor Company, Wilmington, O. Complete description and price on request to the maker.

GASOLINE TORCH.

Every public and private garage should be equipped with a reliable gasoline torch, as its general utility use makes it of much value. Ashton's line of Red-Hot torches are designed to meet every requirement. Illustrated herewith is the No. 10 torch, which is made to supply the demand for a durable, well made article selling at a low price. In the handle is incorporated an automatic pump with automatic check valve. The

tank, which has capacity for one quart of fuel, is made of heavy seamless drawn brass, fitted with concave bottom, which serves as a funnel and prevents the overflow of the gasoline when filling. The



burner is equipped for heating a soldering iron.

This torch is sold under the same guarantee as the remainder of Ashton products: "Satisfaction or money refunded."

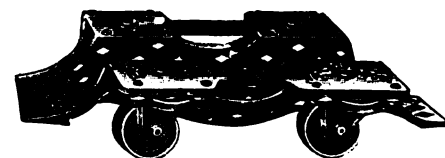
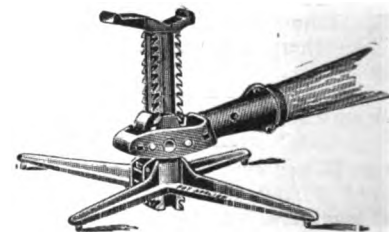
Manufactured by the Ashton Manufacturing Company, Newark, N. J. List price, \$6.80.

CASTER AND JACK.

The simplest way to move a car when space is limited is to place it on casters and then slide it to the desired position. The Norwood three in one combination is designed for this purpose. It consists of a caster for moving and turning automobiles and trucks, and a jack which has a broad base, extended top, long handle and which is capable of lifting and lowering two tons. The jack is also designed to fit the caster so that cars can be moved about while on the jack without danger of accident.

The caster frame is one solid piece of malleable iron and is light, strong and rigid. Ball bearing casters delicately respond, thus permitting the machine to be turned or moved very easily in any direction.

Manufactured by the Automobile and



Accessories Manufacturing Company, 408 Continental building, Baltimore, Md. Write for descriptive circular and prices.

DOVER MEASURE.

One of the most practical measures on the market for garage use is the Dover Saval combination measure and

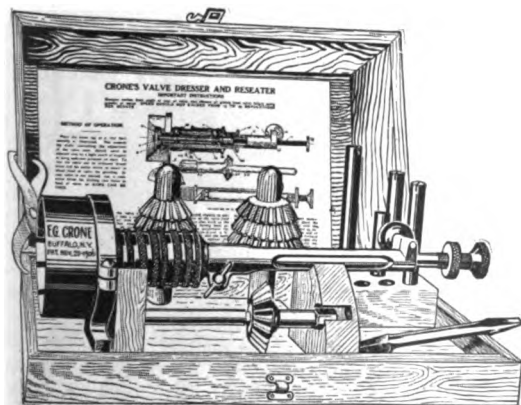


funnel, which also incorporates an automatic shut-off attachment. There are many cars that have the oil tank so situated that the measure must be tipped so that the oil runs out before the filler hole of the oil tank is reached. Usually this means a waste of oil and spilling the lubricant over the engine and other parts. With the Dover Saval measures this waste is prevented by the automatic shut off. As shown in the illustration, the attachment is simple in construction and positive in action. Statement is made that the saving in oil in a single season will more than offset the cost of the device. The finish is heavy copper plate.

Manufactured by the Dover Stamping and Manufacturing Company, Cambridge, Mass. List price of one quart size, \$1; two quart size, \$1.25; four quart size, \$1.75.

VALVE DRESSER AND RESEATER.

The old method of grinding valves with emery or with some compound has many disadvantages. Even after hours of labor it often has been found that the valve is not returned to its original perfect action. Frequently small particles of emery get into the cylinder during the grinding operation and later cut the piston, rings and bore, greatly increasing loss in power. For reseating valves and valve seats of automobiles or of any explosive engine, Crone's valve dresser and reseater has the following advantages: It cuts the valve true with a minimum loss of material, insures accuracy of seat, reduces labor and produces perfect work in about a quarter of the time usually spent in that operation. The com-



plete set, as shown in the illustration, consists of a valve dresser head, spanner wrench, brace bit, follower, carrier and

reseater of 1½ inch, 1½ inch, 1½ inch, two inch, 2½ inch and 2½ inch reseater, and pilots of 5/16 inch, 7/16 inch, ½ inch and ¾ inch. The entire equipment is neatly boxed in a strong oak case. The workmanship and material are of the best and all parts are fully guaranteed.

Manufactured by F. G. Crone, 334 Genesee street, Buffalo, N. Y. List price, \$30.

CHAIN HOISTS.

If the car owner is to do all necessary work on the car there will be times when he will require assistance in lifting heavy parts. In that event a chain hoist in the garage will be found very



convenient. The Simplex chain hoist one of which is shown herewith, is especially adapted to this kind of work.

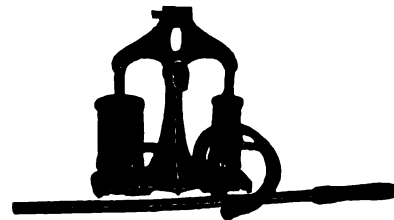
An interesting feature of the Simplex hoists is that they have two speeds, one for full capacity and a second speed for light loads, this being just twice as fast as the former. The brake does not absorb any of the applied power and acts automatically whenever the load hangs suspended from the hoist. Only the best of materials are used in constructing the device; the hooks are of forged steel; the frames and gear of steel or malleable iron and the chains of special refined iron, forged by hand and fitted to gauges corresponding to the sprockets in the wheels.

Manufactured by J. G. Speidel, Reading, Penn. Write for catalogue B, which describes and illustrates Speidel's elevators and hoisting machinery.

When ordering hoists, the capacity and height of lift should be specified.

STEVENS COMPOUND PUMP.

Experts advise that nothing is so detrimental to the pneumatic tire as under-inflation, which is usually due to the

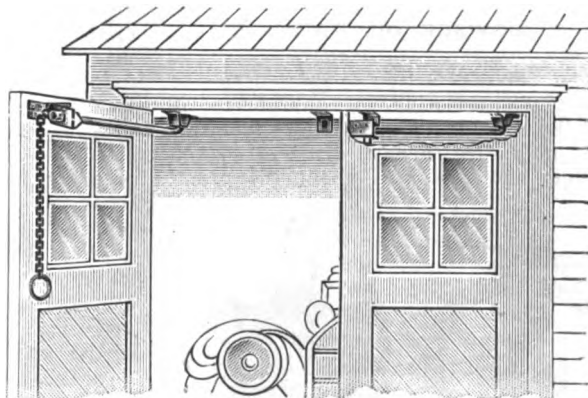


fact that an owner uses a hand pump to inflate his tires. There are hand pumps, however, that are designed to eliminate the hard labor generally involved. One of the best of these is the Stevens No. 99 pump, illustrated herewith, which is of the compound type. One of the cylinders has a bore of 3½ inches and the other two inches. In operation the air is pumped through the larger cylinder into the smaller and the resulting compressed air is then passed on into the tire or storage tank as the case may be. The pump is guaranteed to maintain 200 pounds pressure. Brass is used throughout in the cylinders, bases and ground valves. Three feet of high-grade hose and improved Acorn connection, hard wood base and operating lever are supplied with each instrument.

Manufactured by Stevens & Co., 272 Broadway, New York City. List price, \$12; pressure gauge \$1 extra.

GARAGE DOOR HOLDER.

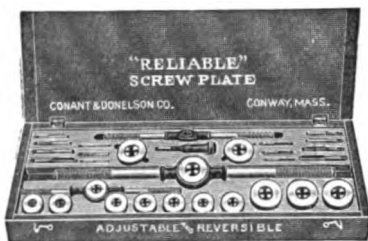
The purpose of the Shelby garage door holder, shown in the accompanying illustration, is to automatically catch the door as it is swinging open to a right angle position or beyond. The door is held firmly in any position until released by a slight pull on the chain. Another feature of interest is that this holder also locks the door as it is closed, the spear head of the latch entering the strike on top of the door frame. The device is strongly constructed of wrought steel and all parts are heavily japanned. Installation is simple.



Manufactured by the Shelby Spring Hinge Company, Shelby, O. Write for price and full description.

RELIABLE SCREW PLATES.

The Reliable screw plate, illustrated herewith, is designed especially for private and public garage use. Each die



in the outfit can be used for hand work, machine work and for cutting close to the bolt head without danger of breaking the threads. This set can be obtained in various sizes and for different forms of threads. Furnished with each outfit is the Reliable bit-brace die holder. This is a handy tool for use in a bit-brace for cutting threads on clips, dressing over bolts without removing them from their places, and in numerous other places where an ordinary stock cannot be used.

Manufactured by the Conant & Donelson Company, Conway, Mass. Write for descriptive matter and prices.

STERLING UTILITY CLEANER.

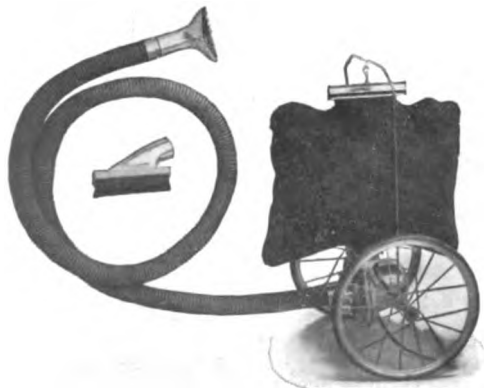
The Sterling utility cleaner, illustrated herewith, is an electrically operated machine designed especially for automobiles, stores, warehouses, churches, schools and telephone switchboards. It is of the portable, self-balancing type, and is neat and compact, weighing but 15 pounds. The outfit consists of machine, 20 feet of flexible cord, eight feet of hose and specially designed toothed nozzle and brush for cushions. Oilless wood bearings are used.

A feature of interest is that the Sterling can be converted into a portable blower in about 30 seconds by simply removing the bag and inserting the hose in its place.

Marketed by the Sterling Sales Company, 343 S. Dearborn street, Chicago, Ill. List price, \$29.50.

BOWSER OIL TANK.

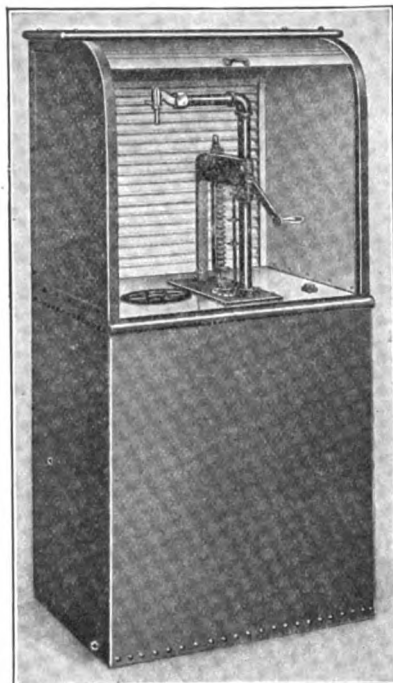
The dissatisfaction experienced in handling lubricating oil improperly is well known. Without adequate facilities it is necessary to have dirty, oil-soaked barrels and measures about the prem-



ises and there is usually a great amount of waste due to evaporation, spilling, leaks, etc.

The problem of suitable storage can be solved by installing a Bowser 52-B outfit, illustrated herewith. This equipment provides means for storing lubricating oil in a compact and clean manner, insuring clean premises and convenience. The standard outfit consists of a quart self-measuring pump, nozzle, rectangular galvanized steel tank, drip pan, stick gauge and roll top cabinet.

As can be seen in the illustration, the pump and top of the tank are completely enclosed by the metal roll top cabinet. The tank, together with the cabinet, insures the freedom of the oil from dust, dirt, lint and other foreign matter.



One complete stroke of the pump plunger draws exactly a quart of oil. Pint or half pint quantities can be pumped by a simple adjustment of the quantity lever. These adjustments are in plain view and easily accessible. The pump cylinder is made of seamless brass tubing, while the valves, valve seats, stuffing box, etc., are regularly made of materials most suitable for the liquid to be handled. A nickel plated anti-drip nozzle is furnished with the pump and is so designed as to effectively stop the flow of oil when pumping ceases.

The tank is made of 14-gauge galvanized steel, with all seams carefully riveted and soldered from the inside to the outside. The finish is in dark olive green. The outfit is also equipped with a six-inch drip pan, so that any oil spilled on the tank is returned to the storage.

Manufactured by S. F. Bowser & Co., Inc., Fort Wayne, Ind. Write for prices and illustrated literature.

BRAKE LINING CUTTER.

The usual methods employed in most garages in cutting brake lining into lengths is to use a hack saw or a chisel,



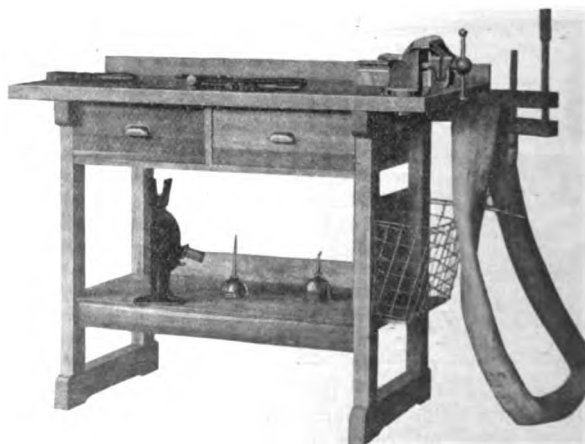
either of which do not afford results as satisfactory as can be obtained by using the Multibestos brake lining cutter, illustration of which is shown herewith. This tool will be found to be one of the greatest time and labor saving hand tools ever designed for the purpose, especially in view of the fact that it can also be used to cut cable, wire and light metals, and that it will easily cut through any brake lining regardless of width or thickness. The blade of the tool, which is removable for sharpening, is of hardened steel and is designed to withstand unlimited hard usage.

Manufactured by the Standard Woven Fabric Company, Framingham and Walpole, Mass. List price, \$1.50.

GARAGE BENCH.

The bench shown in the accompanying illustration is listed as the Auto special No. 88, and is especially designed for use in the private garage. Its dimensions are 48 inches long, 24 inches wide and 36 inches high. The material is Michigan hard wood with built up top strongly bolted together, and the top is covered with galvanized iron. Each drawer is partitioned so that bolts, screws and sundry articles may be kept separate. The bottom of the bench is fitted with three-ply panel and back rail for storage of oil cans and other miscellaneous articles. On the end is a wire basket for waste and sponges. There is also an end extension slide on which tires can be vulcanized.

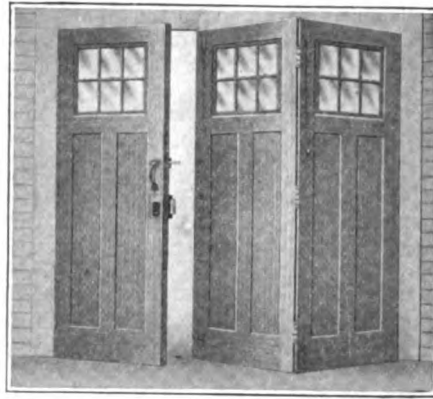
Manufactured by the Grand Rapids Hand Screw Company, 1430 Front avenue, N. W., Grand Rapids, Mich. List price, \$15, not including loose tools or hand screw.



GARAGE DOOR IMPROVEMENT.

Car owners who house their machines in private garages will be interested in a recent development in garage doors, which is known as the Munger three-door combination. Each door measures two feet and eight inches in width and eight feet in height, the three doors fitting a standard opening eight feet square. They are built of Oregon fir and are extra strong and heavy, measuring $1\frac{1}{4}$ inches in thickness. These doors afford an attractive appearance and will harmonize well with the prevailing styles of private garages.

Manufactured by the Chicago Millwork Supply Company, 1399 West 37th street, Chicago, Ill. List price, \$4 each, or \$12 for the combination of three.

**FIRE EXTINGUISHERS.**

While the majority of garage fires are the result of carelessness, yet there are numerous probable causes over which the owner has no control. Insurance companies recognize this and the premiums paid for insurance on this type of property are comparatively high. However, the owner can prepare himself to cope with this condition by placing one or more reliable fire extinguishers conveniently about the garage. One of the best devices for this purpose is the Pyrene fire extinguisher, illustrated here-



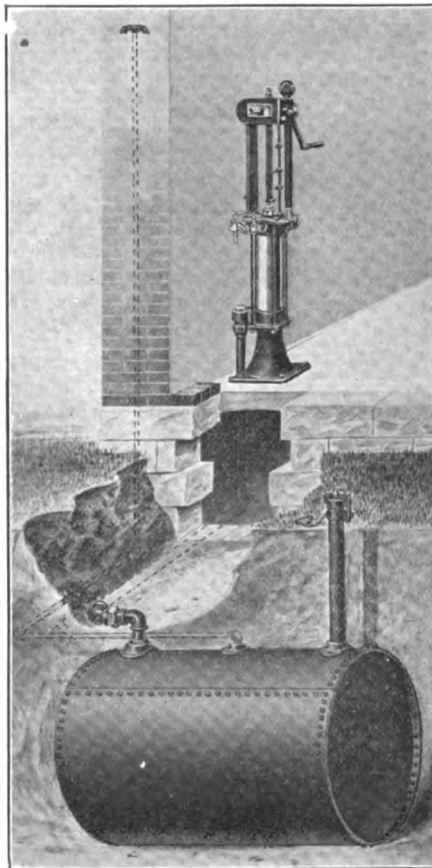
with. The standard equipment of the Pyrene is one quart capacity, contained in a brass and nickel cylinder, which is very light and convenient to handle.

The size and design of this extinguisher is such that it is convenient to carry in the machine. Pyrene can be purchased from almost any dealer in the country, even in the remote communities, or direct from the maker.

Marketed in New England by the Pyrene Manufacturing Company, 88 Broad street, Boston, Mass. Otherwise address the Pyrene Manufacturing Company, 52 Vanderbilt avenue, New York City. List price complete with automobile bracket, \$7.50.

BOWSER STORAGE OUTFIT.

No doubt every private garage owner realizes the numerous advantages to be gained by keeping a surplus supply of gasoline on the premises. The underground tank system, while incurring a rather high initial outlay, possesses innumerable advantages that greatly offset this. Safety, economy of fuel, reduction in price and increase in convenience are among the advantages to be gained with this kind of a system. Illustrated herewith is a view of the Bowser standard No. 41 outfit as it appears when completely installed ready for service. The pump can be placed at any convenient point in the garage, and the tank buried in the ground. The pump and tank may be any distance apart



horizontally, but the limit vertically is 12 feet from the bottom of the tank to the base of the pump.

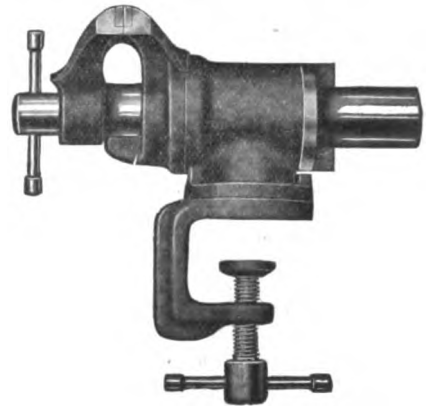
In the garage, with the proper attachments, gasoline may be pumped directly into the reservoir of the automobile without being exposed to the air. The complete outfit is evaporation proof and there can be no loss of liquid from this source.

The pump measures accurately and easily the desired quantities. As the fire risk is kept down, insurance rates are favorably affected.

Manufactured by S. F. Bowser & Co., Fort Wayne, Ind. Descriptive literature furnished on request.

F. & R. AUTO VISE.

Included in the complete line of F. & R. vises is the type illustrated herewith. This tool is especially designed for automobile use because it can be conveniently clamped to the work bench in the garage, or, as the vise weighs complete but $7\frac{1}{2}$ pounds, it can be easily carried in the car and clamped to the running board when needed. The width of the



jaws is two inches and they have an opening capacity of two inches.

Manufactured by the Fulton Machine and Vise Company, Lowville, N. Y. List price of vise having plain jaws and finished parts is \$8.50; when nickeled, \$10.

NEW LANE JACK.

The outstanding feature of the new Lane jack illustrated herewith is that the operator does not have to crawl under the car to place, operate, reverse or take it out. It is equipped with a 30-inch handle that is jointed so that it may be conveniently carried in the tool box. It is operated by very short strokes, the direction of which is controlled by the distance the handle is entered into the socket. If the handle is pushed in for the full distance the jack raises; lowering is accomplished by pulling the handle back about a half inch.

There are two automatic spring notches on the handle which engage the part of the socket that corresponds to these two positions. These notches serve to hold the jack securely onto the handle.

Manufactured by the Lane Brothers Company, Poughkeepsie, N. Y. Further description and price on request.

Giant Merger of Accessory Makers.

Merging of Interests of Five Leading Companies Is Expected to Double Total Earnings.

Motor vehicle industrial interests have found much for speculation in the formation of the United Motors Corporation, in which are merged the Hyatt Roller Bearing, the Remy Electric, Dayton Engineering Laboratories, New Departure Manufacturing and the Perlman Rim companies. Aside from the importance and size of the new combination, the expectation of an announcement that more companies have joined the merger is concerning some trade interests.

The United Motors Corporation, which is incorporated under the laws of New York, is a holding company, owning the securities of the five parts makers mentioned above, each of which is making the standard product in its line. The subsidiary companies will retain their individual identities and remain in the same management as before.

The authorized capitalization of the new corporation is 1,200,000 shares, no par value. The stock started out at 62 and in one day after the opening of the subscription books it had advanced 12 points, to 74. The offering was so heavily oversubscribed that the allotments were limited to 55 per cent. of the amounts subscribed for.

It is announced that only 500 shares of the stock, to be known as Class B, are entitled to vote, and that the operating capital of the company is to be \$6,000,000.

The directorate for the first year, the members of the board being representatives of the companies in the merger, include the following: A. P. Sloan, Jr. (Hyatt), E. A. Deeds (Delco), DeWitt Page (New Departure), S. A. Fletcher (Remy), and L. G. Kaufman, president of the Chatham and Phoenix National Bank, New York. The officers are A. P. Sloan, Jr., president; A. E. Deeds, vice president; DeWitt Page, secretary and treasurer; L. G. Kaufman, chairman of the finance committee.

While the name of W. C. Durant, president of the Chevrolet Motor Company and closely identified with other large financial interests, does not officially appear in the management of the new corporation, it is generally understood he is one of the big factors and that he engineered the deal.

It is confidently predicted that the five companies will show in the new corporation net earnings this fiscal year of approximately \$13,750,000. For the last fiscal year the various units reported net earnings as follows:

Delco	March 31, 1916	\$1,554,319
Hyatt	April 30, 1916	2,484,964
New Departure	April 30, 1916	1,409,244
Remy	March 31, 1916	1,030,103
*Perlman Rim		
Total		\$6,478,630

*Not incorporated until March, 1916.

Recently large extensions have been made to the plants of the first three named companies, and in compiling the following estimate of the net earnings that can be expected from the United Motors Corporation for this fiscal year that fact has been taken into consideration:

Delco	\$2,380,000
Hyatt	4,250,000
New Departure	3,000,000
Remy	1,600,000
Perlman Rim	2,500,000

Total.....\$13,730,000

"The companies comprising the United Motors Corporation," said President A. P. Sloan, "will be operated similarly to those now forming the United States Steel Corporation. The companies have associated for the purpose of a further constructive development of plants and products. As they stand in this new relation today they are backed by the strongest group of bankers in New York."

The Dayton Engineering Laboratories Company, Dayton, O., is better known as the manufacturer of Delco starting, lighting and ignition devices. It furnishes about 25 per cent. of the starting and lighting equipment used by automobile makers.

The Hyatt Roller Bearing Company, Newark, N. J., and Detroit, is an old established concern which specializes in roller bearings and has a plant with daily capacity of about 40,000 sets.

The New Departure Company, Bristol, Conn., was organized 24 years ago and owns fundamental patents on annular bearings. It has three plants, at Bristol, Hartford and East Bristol, producing about 30,000 sets daily.

The Remy Electric Company, Anderson, Ind., specializes in ignition devices of a standard character and are widely used.

The Perlman Rim Corporation, New York City and Jackson, Mich., was recently organized with an authorized capitalization of 100,000 shares, no par value. Its own fundamental patents, controlling a demountable rim for automobiles, and rims made under its patents, are in use by approximately 75 per cent. of the motor vehicles made in this country.

CHANDLER ADVANCES RATE.

Consistent with expectations expressed when the price of its stock advanced 15 points within a month, is the announcement that the directors of the Chandler Motor Company have declared an extra dividend of one-half of one per cent. and increased the rate so that it is now a full eight per cent. per annum.

The Chandler company is in a strong financial position and results thus far indicate a year of substantial profits. Production this year will total about 15,000 cars as compared with 5000 of last year. The company has outstanding \$7,000,000 capital stock. Earnings are expected to run between \$25 and \$30 a share.

Durant Now Rules General Motors.

After Long Fight He Is Elected President to Succeed Nash—Director Strauss Quits.

After a fight lasting six years, William C. Durant has regained control of the General Motors Company, he being elected to the presidency at the directors' meeting held June 1, to succeed Charles W. Nash, whose resignation was made public on the day preceding. There was a lack of harmony among the directors, as is shown by the resignation of Albert Strauss upon the election of Mr. Durant. W. C. Leyland, vice president and general manager of the Cadillac Motor Company, one of the General Motors group, was chosen to succeed Mr. Strauss.

The election is the outcome of a fight that has been waged steadily since 1910, when the general slump in the automobile manufacturing business caught the General Motors Company in a weak financial position. During that year it was necessary to borrow \$16,000,000, and this was done under a voting trust agreement, which forced Durant out of control. J. N. Wallace, Frederick Strauss, James J. Starrow, Emory W. Clark and William C. Durant formed the voting trust, which was dated Oct. 1, 1910, and was to run for five years, or until the \$16,000,000 six per cent. notes, due Oct. 1, 1915, were paid in full. Under the terms of the agreement a majority of the company's outstanding preferred and common stock was deposited.

In the fight that Mr. Durant waged since that time it is generally understood that he had the financial backing of Pierre du Pont and banking interests of New York City. The first concrete evidence that the tide of battle was going to Durant and his backers came with the formation of the Chevrolet Motor Car Company and the quick increase of its capitalization from \$20,000,000 to \$80,000,000. Further support of the evidence was supplied by the shareholders also authorizing the directors to issue new stock at their discretion, giving them authority to exchange new stock for stock of the General Motors Company in the ratio of not more than five shares of Chevrolet for one of General Motors.

In this deal Durant had the opposition of eight directors, but won out. While the fight was going on the stock of General Motors advanced rapidly, selling at one time as high as \$500 a share.

There is talk in financial circles of the possibility of the General Motors Company's directors declaring an extra cash dividend on the \$16,606,000 common stock at the close of the fiscal year July 31. This expectation is based upon the extraordinary earnings of the company and the understanding allowed to exist when the regular \$20 rate was inaugurated last January that stockholders might reasonably expect an extra distri-

bution at the end of the year.

During the current fiscal period General Motors common stock holders will have received dividends of \$70 per share, of which \$50 was the Oct. 15 cash dividend and \$20 has been in regular distribution. This \$70 disbursement involves payment of \$11,550,000.

Extraordinary profits are being reported for this year, it being understood that net earnings for 10 months to April 30 came within a few thousands of \$20,000,000. On that basis net earnings for the full 12 months for preferred and common would run between \$25,000,000 and \$26,000,000. After taking out the \$1,048,000 required to meet the seven per cent. preferred dividend, there would be a balance of between \$24,000,000 and \$25,000,000 for the common, which would be equivalent to about 150 per cent. Expressed in another way, it would mean that after paying out \$11,550,000 in dividends, at the rate of \$70 per share, there would be left a balance of \$13,500,000.

On last July 31 General Motors had a net working capital of \$31,403,000. This amount is likely to be about \$45,000,000 at the close of the 1916 fiscal year, which is a larger sum than a company like General Motors normally would require. If a cash dividend of \$25 to \$30 a share in the form of an extra were declared the working capital would be reduced to only about \$40,000,000.

It has been reported that the company did about \$100,000,000 worth of gross business during the first eight months of the fiscal period, and that if the ratio is maintained the gross for the entire year would be well over \$160,000,000, which would be an increase of \$65,000,000, or nearly 70 per cent. over last year.

In the ratio of gross to capital the General Motors Company is unique among industrial companies. Its capitalization of about \$31,000,000 is supporting a turnover more than five times as much. In view of the present condition of the automobile business it is estimated that this company, providing the conditions remain as good, will in 1917 do \$200,000,000 worth of business on a capitalization of only \$14,985,200 preferred and \$6,506,000 common.

MACAULEY SUCCEEDS JOY.

Following the recent resignation of Henry B. Joy, one of the country's foremost advocates of preparedness, Alvan Macauley, vice president and general manager of the Packard Motor Car Company, succeeds him to the presidency of the concern. Mr. Joy will continue his active connection with the company in the capacity of chairman of the board of directors. He has been identified with Packard since 1899, when it was founded in Warren, O., he transferring it to Detroit in 1903.

Mr. Macauley has virtually been president of the company for the past two years. He is now 44 years of age and becomes the head of 12,000 Packard employees and the custodian of an investment amounting to approximately \$30,000,000.

Overland Joins Huge Motor Merger.

New \$250,000,000 Motor Combination
Will Be Second Largest Corporation in the Country.

The newest and largest combination of automobile and motor accessory companies about which financial and industrial men have been hearing more or less vague rumors for several weeks, has culminated in the announcement that five, and possibly more, of the leading manufacturers of motor vehicles and equipment are being brought together as the nucleus of a new industrial giant which would take rank as the second largest consolidation of industrial interests in the United States.

As the project stands today the capitalization of the new holding company may reach about \$250,000,000, of which amount \$73,000,000 will be in preferred stock, and a total issue of common stock of about 2,500,000 shares with no par value.

The general understanding is, and this understanding has been partly confirmed by John N. Willys, one of the interested and dominating parties, that today the merger embraces the Willys-Overland Company, which next to the Ford company turns out the largest number of motor cars in this country; the Hudson Motor Car Company, another large producer; the Chalmers Motor Company, one of the leading concerns in Detroit, and the Auto-Lite Company, maker of ignition, starting and lighting equipment in huge quantities. The fifth company mentioned is the new United Motors Corporation, which was recently formed to take over control of five leading accessory and parts makers, it being reported that the new holding company will take substantial interest in the corporation. Rumors are afloat that possibly the Fisk Rubber Company and the Peerless Truck and Motor Company will be added to the list.

President Willys' Statement.

As regards confirmation of the report, Mr. Willys had the following to say: "A great many reports have been circulated of the contemplated merger of the Willys-Overland, Hudson, Chalmers, Auto-Lite and other companies. Negotiations are pending which, without doubt, will result in the formation of a holding company, the name of which has not yet been decided upon, controlling the companies.

"The management of the new corporation will be controlled by the motor car interests and not by affiliated banking interests. The Willys-Overland, as well as the Hudson and Chalmers companies, will operate under the same managements and in exactly in the same manner as at the present time. John N. Willys will be president of the new holding company. The capital will be approximately \$200,000,000."

W. C. Durant, the financial wizard, who

has been before the public recently in several huge deals, does not figure directly in the new merger, but he is the controlling interest in United Motors, as well as president of General Motors and the Chevrolet company. It was he who worked with L. G. Kaufman, president of the Chatham and Phenix National Bank, in organizing Chevrolet, Perlman Rim and United Motors.

Mr. Kaufman is to be chairman of the finance committee of the new consolidation, the name of which has not been made public, but is understood will be the American Motors Corporation. Mr. Kaufman issued a statement in which he said the motor industry, the third largest in the country, should be stabilized.

Organizing the Industry.

"The motor car business has grown so rapidly," said Mr. Kaufman, "that it has not had time to get on a settled basis. It is now realized that the automobile is much more than a pleasure vehicle; it has become the agency of a great transportation business. We propose to arrange for its growth in an orderly way."

While details of the financing of the new company have not been announced publicly, it is said that John N. Willys, who had control of the Overland company, received \$90,000,000 for his holdings, \$45,000,000 being in cash and the balance in stock in the new holding company. He is said to have received at the rate of \$500 a share for the stock, the astonishing price being attributed to the fact that it carried control of the company. Surprise at the valuation was considerably lessened when it was learned that last fall a banking syndicate offered \$400 a share for Mr. Willys' holdings.

Earnings of Four Companies.

It is freely predicted that the net earnings of the new company this year will be at least \$30,000,000, two-thirds of which will be the portion of the Willys-Overland company, which is scheduled to turn out about 200,000 cars. The Chalmers company is earning about \$4,000,000 annually, Hudson \$3,000,000, and the Auto-Lite about \$3,000,000. The company's share of the United Motors Corporation are, of course, wholly problematical, in view of the fact that the size of its holdings in that company are at present unknown.

An outstanding feature of the reports to date is the fact that the entire amount of the \$73,000,000 seven per cent. preferred stock will be taken by the "vendors" as a New York banker described it. No offering of this stock will be made to the public.

MORE PACKARD MOTOR STOCK.

The stockholders of the Packard Motor Car Company, Detroit, have authorized an increase in the common stock from \$8,000,000 to \$13,000,000, bringing the company's total capital stock up to \$21,000,000, of which \$8,000,000 is seven per cent. cumulative preferred.

Martin V. Kelley Invades New York.

The Country's Third Largest Advertising Company Opens a New York Branch.

The Martin V. Kelley Company, which ranks third among the advertising companies of the United States in volume of business handled, has invaded New York City, it having opened a branch at 171 Madison avenue. This move is due to Mr. Kelley's purchase of the entire business of Bromfield & Field, Inc., which itself ranked as one of the important advertising agencies in the East.

In connection with the purchase, the Kelley company takes over the following new accounts: The Fisk Rubber Company, Chicopee Falls, Mass.; the Ajax Rubber Company, Trenton, N. J.; the Mercer Automobile Company, F. I. A. T., Boston Woven Hose and Rubber Company and P. Centemerl & Co. With these new accounts added to the \$4,000,000 of business handled by the Kelley company in its Toledo, O., office this year the high standing of the company in advertising circles is obvious.

This company's Toledo office handles the following advertising accounts: Willys-Overland, the largest individual advertising account in the world; the Stewart-Warner Speedometer, Champion Spark Plug, Milburn Wagon, Electric Auto-Lite, Garford Motor Truck, Cole Motor Car, Abbott-Detroit, Cleveland Motorcycle, Enger Motor Car, Perfection Spring, Springfield Body, Temco Electric Motor, Dayton Top Improvement, Buckeye Brewing, Globe Iron Roofing, Guaranty Securities, Superior Underwear and Stewart Phonograph companies.

Martin V. Kelley, who for several years occupied an important executive position with the Charles H. Fuller Company, Chicago, formed the Kelley company a little more than a year ago. In that time it has become one of the most successful and forceful organizations in the advertising business. No small part of the company's phenomenal success is attributed to Mr. Kelley's efficient methods in taking care of his accounts, particularly of the Willys-Overland company, which he has handled personally for about six years.

In taking over the Bromfield & Field company Mr. Kelley retains the services of Russell A. Field, treasurer of the concern, who becomes a vice president in the Martin V. Kelley Company. Mr. Field is one of the most widely known men in eastern advertising fields.

COMPANY CHANGES NAME.

Since the Hartford Suspension Company, Jersey City, N. J., widely known as the maker of Hartford shock absorbers, has taken up the manufacture of several accessories, the directors have felt the name of the company was a misnomer and consequently at a recent meeting changed it to Edward V. Hart-

ford, Inc. This name was chosen as a mark of esteem for President Edward V. Hartford, who invented the accessories and appliances produced by the company. It has been made clear that there will be no change in personnel or ownership.

The Hartford company is an extensive advertiser and has suffered a certain amount of confusion in its mail, a large number of its letters having been directed to Hartford, Conn., instead of Jersey City, the senders evidently believing the company as a Hartford concern. The new name will no doubt overcome this trouble.

OVERLAND PLANT IN FILMS.

The methods by which Overland cars are manufactured have been recorded in moving pictures, two photographers having spent about three months in filming the processes at the huge Willys-Over-



Martin V. Kelley, President of One of America's Largest Advertising Companies, Which Bears His Name.

land plant at Toledo. The film is entitled "The Manufacture of an Automobile," and shows every operation of the building of modern motor cars.

The entire working force and plant were placed at the services of the photographers, who therefore had about 20,000 "actors" performing before their cameras. That it required about a quarter of a year to complete the film is partly due to the immensity of the plant and to the fact that the photographers had to make special arrangements for lighting, grouping, etc. As an instance, it required the services of five electricians to move the apparatus through the plant and the use of 10 specially constructed trucks, operated by 20 men. To arrange the wire to supply the current for the powerful lights used to illuminate every corner to a brightness that would permit every form of photography required about four weeks' time.

Five More Parts Makers Combine.

Interests Taken Over by Motor Products Corporation, a New \$10,000,000 Concern.

In the granting of a charter at Albany, N. Y., to the Motor Products Corporation, with an authorized capitalization of \$10,000,000, is revealed another combination of interests of prominent makers of automobile accessories and parts. The companies embraced in the merger are the Rands Manufacturing, the Vanguard Manufacturing, the Universal Metal, all of Detroit, the Superior Manufacturing of Ann Arbor and the Diamond Manufacturing Company of Detroit and Walkerville, Canada.

The new corporation has an authorized capitalization of 100,000 shares of no par value, of which 70,000 are being offered for public subscription. The stock is divided into two classes, A and B, the second named having full voting power, while the other class has not, unless the company fails to earn \$5 per share per annum for two consecutive years, in which case both classes have full voting power. At the outset the subscription price was \$74 a share, the brokers reporting that the issue was oversubscribed 100 per cent.

The officials will be W. C. Rands (president of the Rands company), president; D. B. Lee (vice president of the Diamond companies), treasurer and general manager; C. F. Jensen (president of the Vanguard company), vice president and overseer of purchases; H. H. Seeley (president of the Superior company), vice president and sales manager; H. Louis Brown (treasurer of the Universal company), secretary and manager of the tube mill. The directorate includes the officers and R. R. Seeley, who will be production manager also.

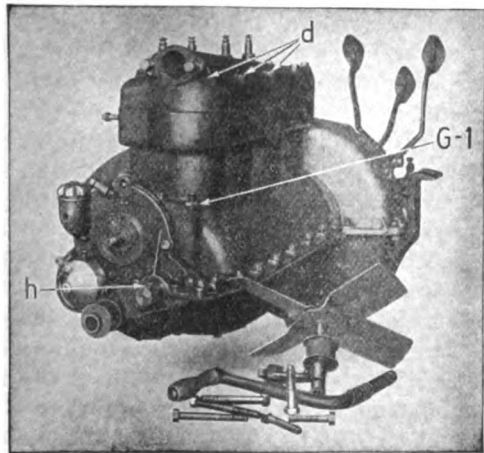
While all the companies are well recognized as windshield manufacturers, President Rands states that eventually only about 30 per cent. of the total business of the corporation will be in that particular field. Plans for the future include the installation of a drop forge plant and a large screw machine department. The present output of the five companies includes, besides windshields, such motor parts as steering wheels, winter and collapsible tops, radiators and radiator tubing, hubs and hub caps, manifolds, lighting systems and metal shapes of all kinds.

The Motor Products Corporation starts with exceedingly bright prospects, it being reported that the companies have on their books business amounting to approximately \$8,000,000, with assurances that this total will be greatly augmented. Mr. Rands states that he believes the companies will be brought together in one monster manufacturing plant in the near future, on a large tract of land on which options have already been secured. The location of the land has not been made public.

MOTOR STARTING AND CAR LIGHTING.

The Westinghouse Starter-Lighter Equipment for Ford Chassis and Its General Construction and Operation—Preparing the Car for Its Installation.

THOUGH the model T Ford chassis are equipped with a dynamo constructed with the flywheel carrying the revolving part, the 16 magnets on the flywheel turning close to a circular field member on which is mounted the 16 "spools" or coils, this is an alternating current machine and cannot be used for charging a battery. At all road speeds in excess of about 10 miles an hour the Ford dynamo will supply sufficient current to normally illuminate the lamps, but when the speeds are less than 10 miles the lamps will be automatically reduced, their light value quickly diminishing in power. The Ford dynamos, until the 1915 chassis were built, had a normal current production of approximately 14 volts, using $\frac{5}{8}$ -inch magnets, and being intended for ignition only, but with the increase of the magnets to $\frac{3}{4}$ inch the current production has



The Ford Engine Stripped and Ready for Installing the Westinghouse Starter-Lighter.

been increased, so that the rating may be regarded as about 18 volts. The increase was intended to afford sufficient current for both ignition and lighting the lamps.

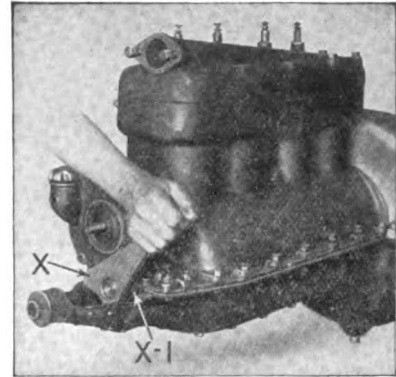
But no matter what the value of the current produced by a Ford dynamo, there is necessarily fluctuation of the current with the variance of the engine speed and when driven slowly the lights will diminish in power. When the car is standing, unless the engine is idling, no current can be furnished for the lights. To idle the engine during stops means unnecessary consumption of fuel and oil, and there is always the danger of the vehicle being accidentally started, perhaps causing damage or injury to property or person, as well as leaving it exposed to theft. Because of the constantly increasing knowledge of cars, both mechanically and driving, particularly those types used in largest number, the wisdom

of guarding against thieving is unquestioned.

These considerations have impelled many owners to install in Ford chassis at their own expense different lighting systems that are serviceable at all times, and because of the greater convenience many have sought combination lighting and starting equipment. Some have even gone beyond this and added ignition, dispensing with the standard Ford equipment because they believed they would obtain higher efficiency and more satisfactory service.

Of the standard lighting and starting systems designed especially for Ford chassis, the Westinghouse equipment, built by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Penn., has been carefully developed. It is not cheap in the sense of low price, but it is guaranteed to afford every requirement and be thoroughly dependable and efficient in any service. When desired this system can have added an ignition unit so that the timer, coil, and, in some cases, master vibrator, can be removed. This ignition unit includes a coil, condenser, interrupter and distributor, and it is supplied with current drawn from the battery. One wire to the dash is all that is required.

The Westinghouse starter-lighter, as the equipment is designated by the manufacturer, is a single-unit machine, it having two poles, with the wiring so arranged as to obtain the desired control. This is used with a 12-volt battery. The system is the single-wire, or "grounded" return, which is characteristic of practically all Westinghouse equipment.

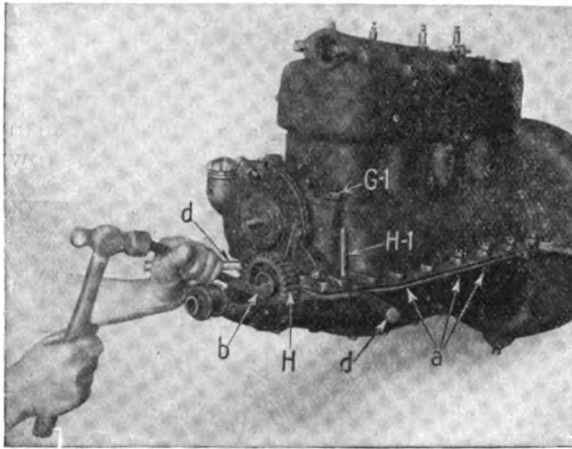


The Manner of Using the "Bulldozing" Tool to Expand the Lower Section of the Crank Case.



Shaping the Expanded Crank Case Section to Obtain Sufficient Clearance and for the Chain Sprocket.

The starter-lighter is built with a rectangular frame of cast steel that is open at either end, and at the top and bottom the laminated field poles



How the Sprocket Hub Is Installed on the Forward End of the Crankshaft.

are installed. The side walls are slightly cut to afford clearance for the armature, for the design is such that the armature is comparatively large in diameter and short in length. The end plates are aluminum castings, slightly recessed from the base flanges, and these are each secured to the frame by four bolts and nuts. There is a central recessed housing for the commutator in the rear plate, and around this housing the brush rigging is secured. Both end plates carry large annular ball bearings in which the armature is mounted. There is an opening in the commutator housing, which is covered with a thin metal spring strap, or collar, through which the commutator and brushes can be examined without dismantling the machine, and this strap is easily and quickly removable.

Slotted Drum Type Armature.

The armature is a slotted drum type of comparatively large diameter and is constructed with a shaft of nickel steel that carries a core of soft iron laminae, which is channelled longitudinally and in which the windings are laid. The commutator is built of high-grade copper segments that are insulated with mica. The commutator is of large size and so constructed that it should be extremely enduring. The field coils are formed independently and before being installed on the field pieces are impregnated with a special insulating compound. The armature is similarly insulated and is thoroughly protected against moisture. The windings of the field coils of the machine are what are known as reversed series, and three brushes are used. The internal connections are made from the motor-dynamo terminal through the series field and to the negative brush. The positive brush is grounded. One end of the shunt field winding is attached to the regulating third brush and the other end of the shunt field winding is grounded. This design affords what is known as inherent regulation.

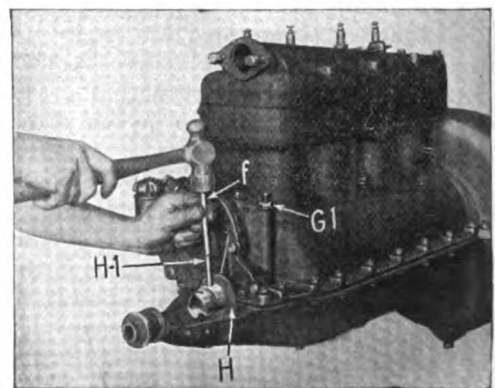
The electrical output of the electric unit is designed to keep the battery charged under normal operating conditions. The generator is coupled to the engine by a silent chain, and when the circuit is closed by the starting switch the unit takes current from the battery and will drive the engine at a speed from 150 to 175 revolutions a minute. As the engine begins to fire the unit then becomes a generator and when the engine speed is 400 revolutions it will furnish current for the lights and for charging the battery. At highest speeds the charging current is tapered off so that the battery is not overcharged. The unit is driven at $2\frac{1}{4}$ times the crankshaft speed of the engine. To prevent the machine serving as a motor at low speeds, which would cause a drain upon the battery, an automatic cut-out disconnects it from the battery whenever the engine speed falls below the generating point fixed by the design.

Designed to Have Long Life.

The construction is such that driven at the comparatively low speed the machine has low life. The bearings are exceptionally large and the sprockets are high-grade steel. The driving sprocket has a cushioned positive drive in the starting direction and friction drive in the generating direction. The friction drive is adjustable for wear without removing any part of the equipment.

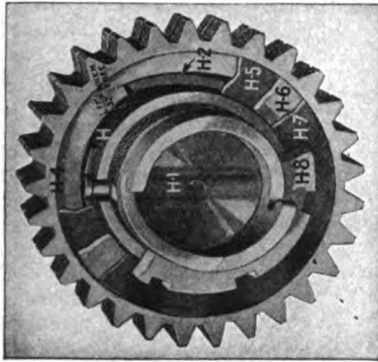
The electric unit is mounted on the left side of the engine and the battery is installed in a box that is carried on the right running board. The starting switch and generator cut-out are located in the footboard about two inches from the left side of the car frame. The terminals are toward the right side of the chassis. The magnetic switch in the generator circuit is intended to automatically connect the generator to the lighting system and battery when the engine is running at what would correspond to nine miles an hour car speed when on the direct drive, but when running on the low gear ratio the switch closes at a much lower speed.

If no lights are in use the generator will begin to charge the battery when this switch makes the electrical connection, but if the lights and



Inserting the Pin Retaining the Crankshaft Sprocket with a Drift and Hammer.

burning the generator will furnish part of its current to them. As the speed is increased the proportion of the current supplied by the gener-



The Complete Assembly of the Sprocket Installed on the Crankshaft.

ator increases until, at approximately a car speed of 15 miles an hour, the generator supplies all of the current to the lights and in addition charges the battery. The value of the current supplied to the battery depends upon the

number of lamps burning and the speed of the engine.

Can Be Easily Installed.

These systems are constructed with such simplicity that they can be installed by practically any mechanic, or by any owner who has average mechanical knowledge, for with the equipment is supplied the special tools that are necessary for adapting the Ford engine for the installation. The Westinghouse starter-lighter outfit is shipped with complete instructions, which are fully illustrated, so that each operation can be thoroughly studied and understood before the work is begun. With these instructions no mistake can be made and the equipment can be installed in a comparatively short time.

The motor-generator is mounted at the forward end of the engine, at the left side of the cylinder block, and is supported by a bracket or lug that is secured by the three forward bolts that retain the cylinder head of the engine, and by a second bracket or lug that is seated on and is retained by the left through bolt that retains the forward main bearing. This insures positive seating of the unit and secures it against any possible movement that might result from the stresses of the silent chain by which the unit is driven from crankshaft of the engine.

Preparations for Making Installation.

In the preparation for the installation of the unit the owner or mechanic should systematically examine the ignition system and make whatever adjustments may be necessary to have the engine fire evenly and regularly, this being essential no matter whether the ignition unit that may be installed with the starter-lighter is to be fitted or not.

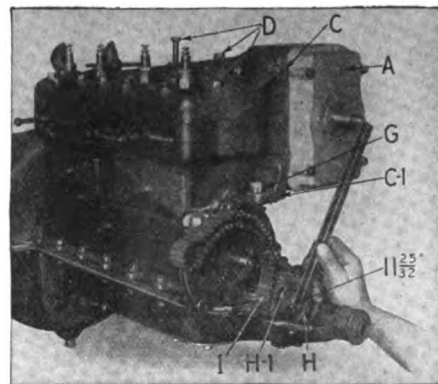
When the engine is firing smoothly it is then in condition for the installation, which is begun by draining the radiator and disconnecting the water outlet and inlet manifolds from the engine and by removing the radiator from the chassis. This may be done by loosening the bolts that secure it to the chassis frame, and disconnecting

the radiator stay that extends from the radiator to the dash. The stay may be drawn back through the dash after it has been unscrewed in the socket on the radiator. With the removal of the radiator and the water manifolds the engine can be easily worked on from in front or from either side of the chassis, and the forward end of the crankshaft can be conveniently reached. When this has been done the fan bracket should be taken off, which requires loosening the clamping bolt. This leaves the entire forward part of the engine clear. A precaution is the removal of the timer, which might be damaged by the work, and this is done by simply swinging the clamping spring and placing the timer where it will be out of the way.

When this has been done the crankshaft of the engine ought to be turned until the pin in the fan pulley is perpendicular, as is shown by the letter h in the first illustration. The starting crank can then be taken off by removing the bolts that retain it and the pin retaining the fan pulley on the crankshaft should be driven out.

The lower section of the crank case has a tapered extension forward from the web that forms the front end of the crank chamber, and to this is riveted the crank case forward end bearing, which supports the forward end of the engine. At the front end of the bearing is a short sleeve or collar which supports the engine crank, and the crank case front frame bearing, with a cap that is retained by two bolts, carries the engine. The crank is removed from the collar or bearing, but the bolts securing the crank case bearing to the frame are not disturbed.

The crankshaft, in front of the crank case web, carries the fan pulley. As designed, there is sufficient clearance in the extension for the fan pulley, but the sprocket that is put on the crankshaft in place of the fan belt pulley is somewhat larger, and to put the sprocket on the shaft and insure full space for the chain, the extension, which is pressed steel, must be spread under the end of the engine shaft. The metal is expanded by what is known as a "bulldozing" tool, which is fitted over the end of the crankshaft and swung on the shaft by the handle. This brings the "bulldozing" end of the tool against the steel, forcing it outward.



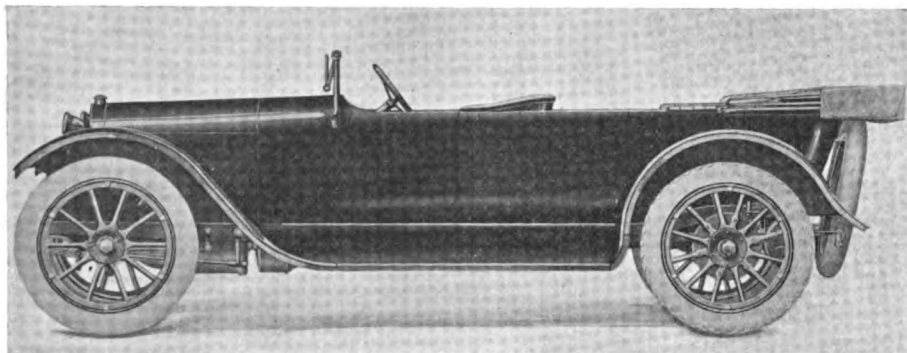
Determining the Distances Between the Centres of the Armature and the Engine Shafts.

(To Be Continued.)

NEW LOW PRICED ELCAR.

Has 34 Horsepower Motor and Sells for \$795 Fully Equipped.

Selling at \$795, fully equipped, the Elcar, manufactured by the Elkhart Carriage and Motor Car Company, Elkhart, Ind., and distributed in New England by the Paine-Krogman



The New Five-Passenger Elcar Touring Model, Mounted on the Same Chassis as the New Elcar Roadster.

Company, 910 Commonwealth avenue, Boston, Mass., affords exceptional value for the outlay. The motor is of the four-cylinder, cast en bloc, L head, high speed, long stroke type. It has a bore of $3\frac{1}{2}$ inches and a five-inch stroke, and develops 34.7 horsepower at 1800 revolutions in actual brake test.

Cooling is by the thermo-syphon method, assisted by a two-blade propeller fan. The Carter carburetor is used because of its particular adaptability to the Elcar motor. Gasoline is stored in a 14-gallon tank suspended at the rear of the chassis and the fuel is supplied to the carburetor by the vacuum system. Lubrication is by means of the splash, constant level system, the level being maintained by a plunger pump driven by an eccentric on the camshaft. The power plant is suspended by the three-point method.

The electrical system is of the two-unit Dyneto type and consists of a generator driven by the camshaft through reduction gears. It is rigidly mounted on the forward end of the crank case and supplies current for charging the six-volt, 90-ampere hour storage battery, mounted on the frame of the car, and a starting motor. Ignition is by the Delco system, which incorporates an automatic spark advance.

The flywheel and cone clutch are wholly enclosed in a bell housing, the forward half of which is cast integral with the motor crank case. The clutch has a leather facing with spring inserts to insure smooth engagement. In the transmission, which is of the selective sliding gear type, there are three speeds forward and reverse. The housing is cast integral with the rear half of the clutch housing.

The front axle is a drop forged "I" beam section with heavy Elliott type yokes and integral spring pads. The rear axle is of the floating type.

Special alloy steel, heat treated, is used to form the springs. The front pair are of the semi-elliptic type and are $1\frac{1}{2}$ inches wide by 34 inches long. Three-quarter elliptic springs are used at the rear. These are two inches wide by 46 inches long and have six leaves. Artillery type wheels are standard on the Elcar and are fitted with demountable rims carrying $32 \times 3\frac{1}{2}$ -inch straight side tires. The wheelbase is 114 inches.

Bodies can be furnished in two models, they being listed as models A and B. The first mentioned is a five-passenger full streamline yacht type touring car, while model B is a roadster type with cloverleaf arrangement for seating four passengers.

REGAL OFFERS NEW MODEL.

Five Passenger Streamline Body Mounted on 108 Inch Chassis.

The Regal Motor Car Company, Detroit, Mich., announces a new Regal 4 thirty-two, which is known as the model J. The four-cylinder motor was designed and made in the Regal factory. The cylinders are cast en bloc and are integral with the upper half of the crank case. This engine is of the L head type, has $3\frac{1}{2}$ -inch bore and $4\frac{1}{4}$ -inch stroke, and is capable of developing 32 horsepower. Valve heads and pistons are made readily accessible by the removable head. The lower half of the crank case is made of pressed steel and thoroughly ribbed for strength and rigidity.

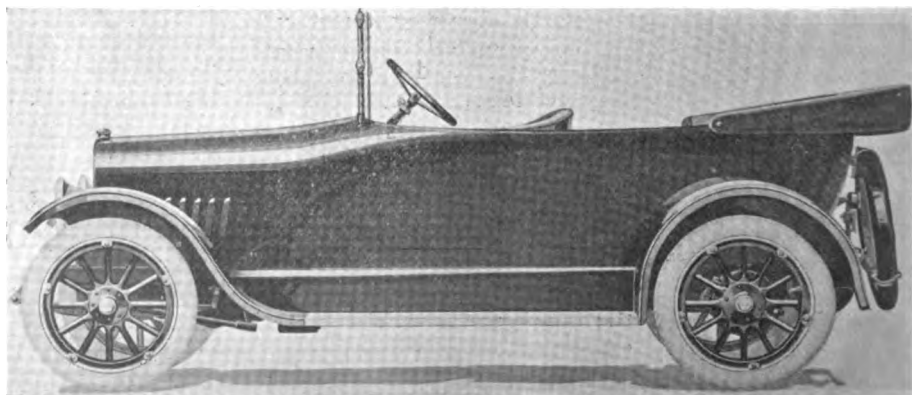
Lubrication is by the constant level circulating splash system and the carburetor is of the float feed variety and is hot air jacketed. It is mounted close to the cylinders on the left hand side. The supply of gasoline is carried in a 14-gallon tank secured to the rear of the chassis and is supplied to the carburetor by the vacuum feed. Cooling is effected by natural circulation and a three-blade propeller fan which is 16 inches in diameter. The clutch is a leather faced cone of light pressed steel, with spring inserts under the leather facing to insure gradual engagement. The transmission is of the selective sliding gear type, with three speeds forward and reverse.

The electrical equipment consists of the Heinze-Springfield two-unit starting, lighting and ignition system. Direct gear from the camshaft is used for driving the generator. The breaker and distributor are of magneto type and are located with coil and regulating switch integral with generator, thus greatly simplifying the wiring.

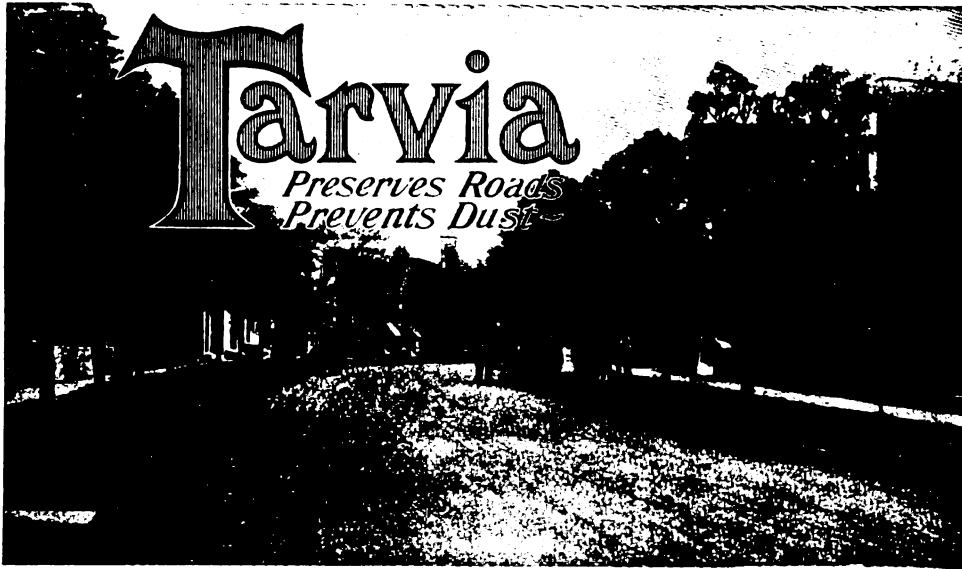
The front axle is an I beam drop forging with the tie rod located at the rear. The three-quarter floating rear axle and differential are carried on Hyatt high duty bearings.

Artillery type wheels made of second growth hickory are standard on this car. All wheels have 12 spokes and demountable rims carrying $30 \times 3\frac{1}{2}$ -inch tires. Non-skid oversize tires will be fitted to the rear wheels if desired. Semi-elliptical $34 \times 1\frac{1}{4}$ -inch springs are used at the front of the car, while 40×2 -inch cantilever springs are mounted under the frame at the rear.

The car has a wheelbase of 108 inches and a road clearance of $10\frac{1}{2}$ inches. The body, which has seating capacity for five passengers, is of the full streamline type, and is finished in Regal blue. It is upholstered in straight grained, semi-gloss Fabrikoid. The wheels are finished in Regal blue; the hood, fenders and radiator black enameled, and the chassis is finished in black. The price of the car is \$695 f. o. b. Detroit, Mich.



The Regal 4 Thirty-Two, the New Model Which Has 108-Inch Wheelbase and Sells for \$695 Completely Equipped.



*Columbia Avenue, Vandergrift, Penna.
Tarvia-Mixed-Macadam over
worn brick pavement*

Tarvia over Brick—

WHAT to do with a worn out brick pavement has long been a problem to municipal engineers. Rough, noisy and dirty, such old pavements are a nuisance.

In the instance pictured above (and in many other recent cases), the problem has been solved by applying a wearing surface of crushed stone and Tarvia over the old brick pavement.

Tarvia alone among the bitumens used for paving and road making possesses the capacity of adhering to cold surfaces. Accordingly it bonds readily to an old and rough brick pavement which really makes an ideal foundation.

In the above instance "Tarvia-X" was mixed with a suitable grade of crushed stone in an approved power mixer and

spread over the brick to a depth of three inches. It was then compacted by rolling to a finished depth of two and one-half inches. This has proved to be an ample thickness.

23,000 square yards of brick pavements were covered in this manner at Vandergrift, Penna., and there has been no scaling off or rolling up of the surfacing material. The above photograph was taken after the street had been subjected to a year of lively traffic.

This method of resurfacing old, worn out brick pavements has been used for several years with great success. The same general method is used over other types of block pavements.

We shall be glad to give the technical details to any engineer or property owner who is interested.

Booklets on request. Address our nearest office.

Special Service Department

This company has a corps of trained engineers and chemists who have given years of study to modern road problems.

The advice of these men may be had for the

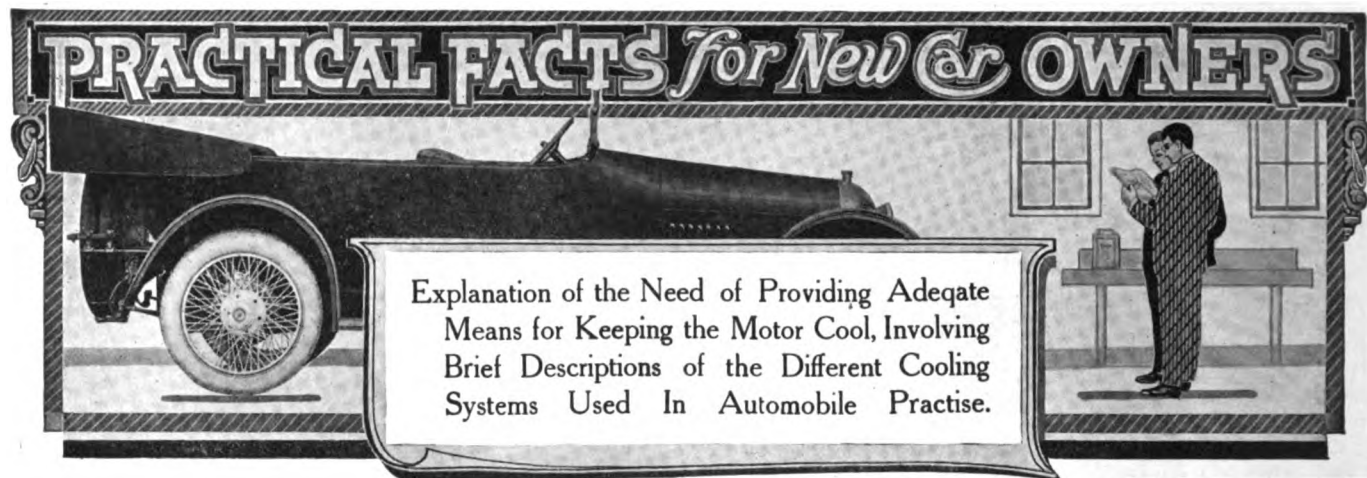
asking by any one interested.

If you will write to the nearest office regarding road problems and conditions in your vicinity, the matter will have prompt attention.

The *Barrett* Company

New York Chicago Philadelphia Boston St. Louis Cleveland Cincinnati Pittsburgh
Detroit Birmingham Kansas City Minneapolis Nashville Salt Lake City Seattle Peoria
THE PATERSON MANUFACTURING COMPANY, Limited: Montreal Toronto Winnipeg
Vancouver St. John, N. B. Halifax N. S. Sydney, N. S.





Explanation of the Need of Providing Adequate Means for Keeping the Motor Cool, Involving Brief Descriptions of the Different Cooling Systems Used In Automobile Practise.

WHEN it is considered that the temperature inside an automobile cylinder ranges between 2000 and 3000 degrees Fahrenheit at the instant of combustion, then it will be understood why the cooling system of a motor is vital to satisfactory operation. If an adequate means of keeping the cylinders cool were not provided the metal of the walls would expand and prevent the piston from traveling up and down, which would result in an inoperative motor.

There are two methods for cooling the internal combustion engine. By cool, is not meant condition which the average lay man is apt to believe, but a temperature which will afford smooth operation without causing preignition. A motor is said to be cool even though the operator cannot place his hand upon the metal with comfort. Air cooling is the older system, but with the rapid development of the automobile this method gave way to water cooling, this system being the most used in present day cars.

The Water Cooling System.

Let us first consider the water cooling system. The principle involved is to pass a supply of water around the cylinder walls so as to maintain a temperature sufficiently low to allow operation. For this reason, water jackets are placed, usually cast integral, around the cylinders. As the quantity of water which a machine can carry for cooling purposes is limited, it is imperative that some provision be made for rapidly cooling this water, less it become so heated as to be useless as a cooling agent. For this reason every water cooled machine is provided with some type of radiator, which consists of a system of small pipes and two reservoirs. The radiator is designed so that air is circulated around the small pipes and thus the water is materially cooled as it passes through the pipes from one reservoir to the other.

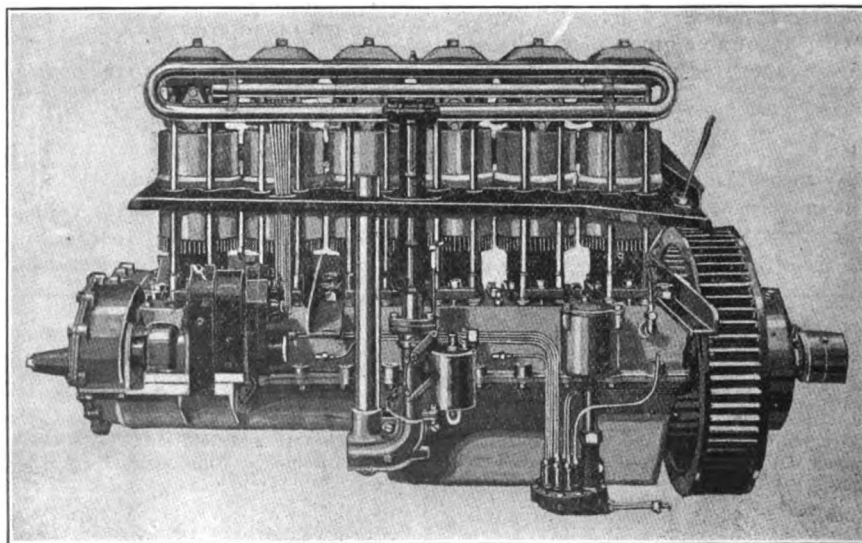
Water circulation is divided into two types, thermo syphon and forced. The first mentioned is the simpler. This is designed to utilize the natural law of hot water being lighter than cold. The circulation is absolutely automatic, no pumps being used. The water in the water jackets around the cylinder is, of course, much hotter than the water in the radiator, therefore the cool water flows from the lower reservoir of the radiator and replaces the water in the jackets and forces it to flow upwards and into the top reservoir of the radiator. This water is then cooled as before described and results in a continuous circulation.

The cooling system used in the Overland car is of the thermo syphon or natural circulation type. In addition to the water the system incorporates an auxiliary fan. This is located in front of the motor and just behind the radiator and when in motion draws air through the radiator, cooling the water there, and then directs it on the engine. In the accompanying illustration of the Overland engine, the water located in the water jackets, A, becomes hot, due to the explosions within the cylinders. The hot water expands and is forced up through the pipe B and into the top reservoir of the radiator at the point marked C. The water then enters the large cooling surface D of the radiator, where it is rapidly cooled and, becoming heavier, sinks to the bottom reservoir and then again re-enters the cylinder jackets. The direction of flow is indicated by the arrows.

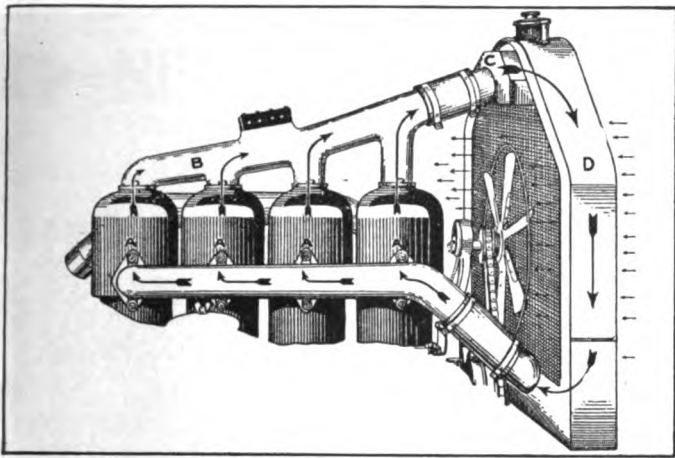
Pump Circulation Is Positive.

The pump circulation is often termed the positive circulation because the pump is controlled by the engine and its action is absolutely positive. If the engine is operated at a high speed the circulating pump will also be operated at a corresponding speed, thus causing a large body of water to be forced around the cylinders. Advocates of the natural circulation argue that the mechanical circulation system is inadequate because it is not adapted to all conditions. They state that when the motor is laboring under a heavy load at slow speed, the circulating pump, being controlled by the engine, is compelled to operate at a corresponding slow speed, and the water pumped around the engine is not sufficient for cooling purposes.

The cooling system on the Studebaker Four is of the forced circulation type. This system contains 10 quarts of water and consists of a radiator, hose connections, water line, pump and water jackets, which are incorporated with the cylinders. The radiator, A, is filled with water and when the motor is running the centrifugal pump, B, forces the water to circulate as follows: From the pump it is driven through the lower water line into the cylinder water jackets. Here it absorbs the heat and goes on to the upper water line and thence to the radiator. In the radiator the water percolates slowly down through many fine tubes, C, and is cooled by the air rushing between the fins surrounding the tubes, and then returns to the pump. A fan, D, on the front of the motor, belted to the crankshaft, pulls the air through the ra-



Showing Franklin Motor, Which Is Cooled by the Air Method—Fan Incorporated in Flywheel Draws 2200 Cubic Feet of Air Per Minute Over Cylinders.



Thermo-Syphon Water Cooling System Used in Overland Cars
—Auxiliary Fan Ample Assists Operation.

diator and facilitates the cooling operation.

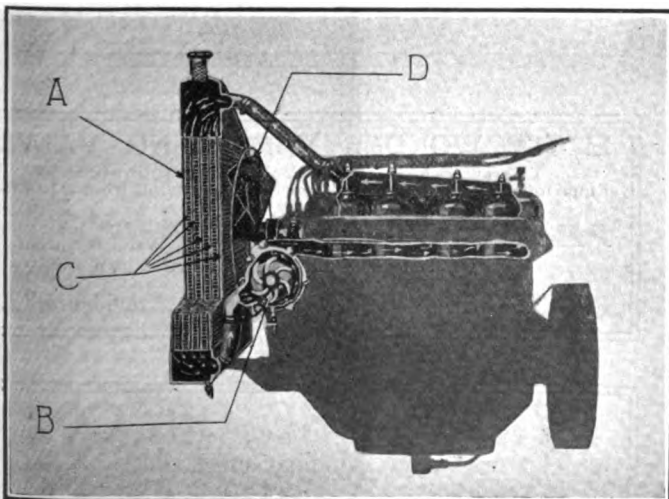
This type of pump requires no other attention than to see that it does not become clogged through use of dirty water. There is a packing nut on the shaft, which, should the pump ever leak around the shaft entrance, can be re-packed. This can very easily be done by turning off the packing nut, removing the old packing and rewinding the shaft with a few inches of well graphited packing and tightening up the packing nut. The packing should be wound on in the same direction as the nut is tightened.

Merits of Air Cooling System.

For the past few years more motorists have been investigating the merits of the air cooling system than ever before. The advantage of this system is that it requires no attention. It has been found that the water cooling system is efficient only when the temperature of the water is maintained under 212 degrees, this being the boiling point. On the other hand, when the air cooled system is used, the cylinder walls may have a temperature of 500 degrees or even higher, yet it is possible for the engine to be in perfect operative condition. The absence of water from the air cooled system eliminates freezing trouble in cold weather and the boiling over troubles in the summer time.

The Franklin motor, shown in the accompanying illustration, is a good example of the air method of cooling. The cooling depends on one moving part only, the flywheel, in which is incorporated a special fan, which can draw in over the cylinders 2200 cubic feet of air per minute when the speed of the motor is about 1500 revolutions per minute.

Each cylinder is provided with radiating fins which project from the periphery. Around the radiating fins of each cylinder is placed a sheet metal jacket from which a partition extends that separates into two sections the space enclosed by the hood and the engine boot.



Studebaker Four Motor Employs Forced Circulation, the Water Being Driven Through the Cylinder Water Jackets by a Positive Driven Pump.

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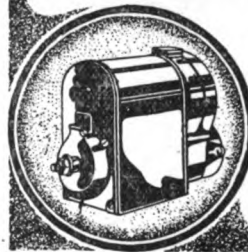
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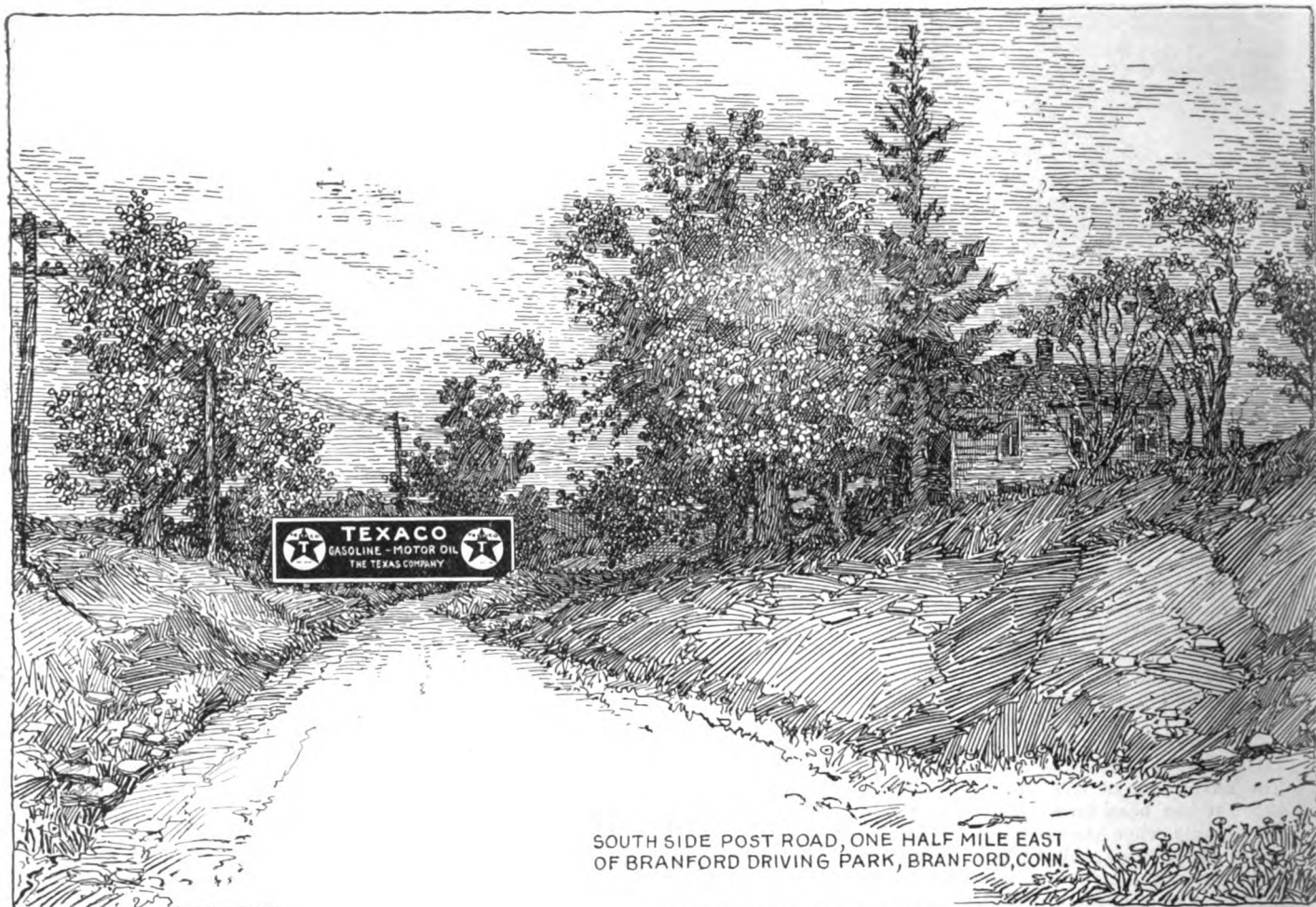
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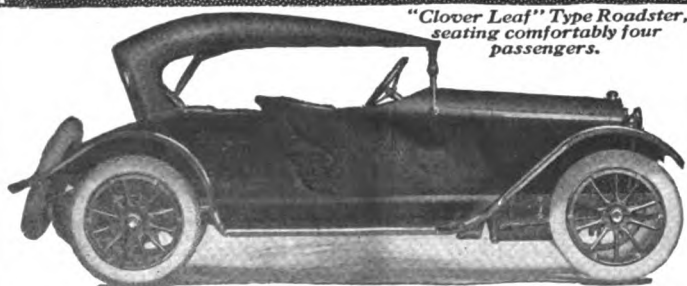
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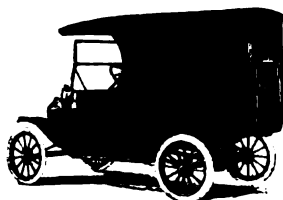


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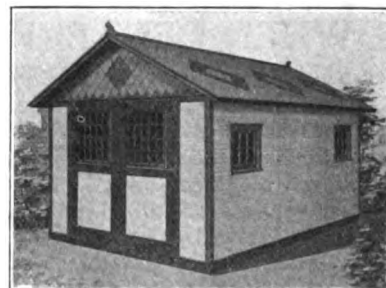
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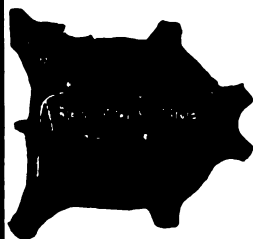
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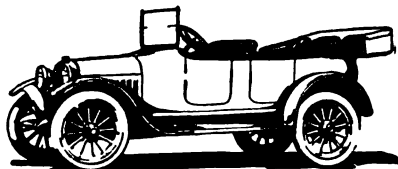
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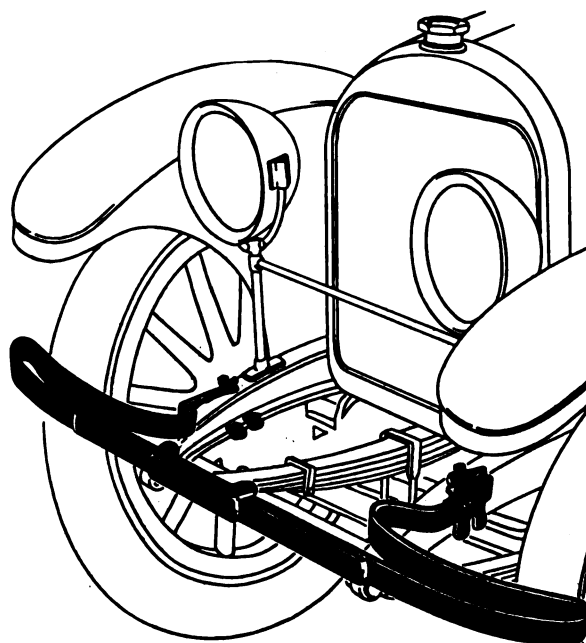
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147 Morgan Street, Jersey City, N. J.

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MICHELIN TIRES



**5 full pages
of MICHELIN
advertising in
*THE SATURDAY
EVENING POST*
within 8 weeks**

Advertisements like these in conjunction with other large advertisements appearing over the dealer's own name in his home newspapers are telling people about the high quality and low price of Michelin tires.

This combination of tire value and forceful advertising makes the Michelin proposition the best ever offered to tire dealers.

**Michelin Tire Company
Milltown, N. J.**

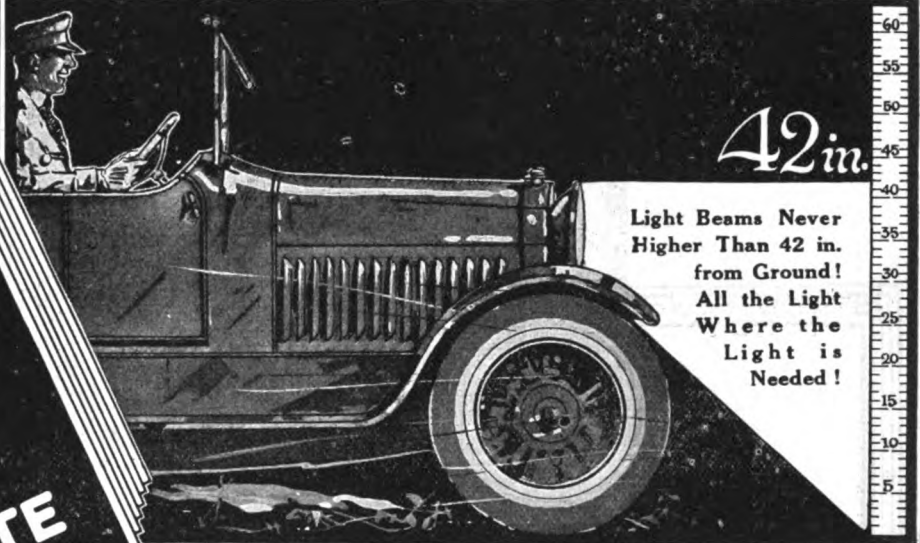
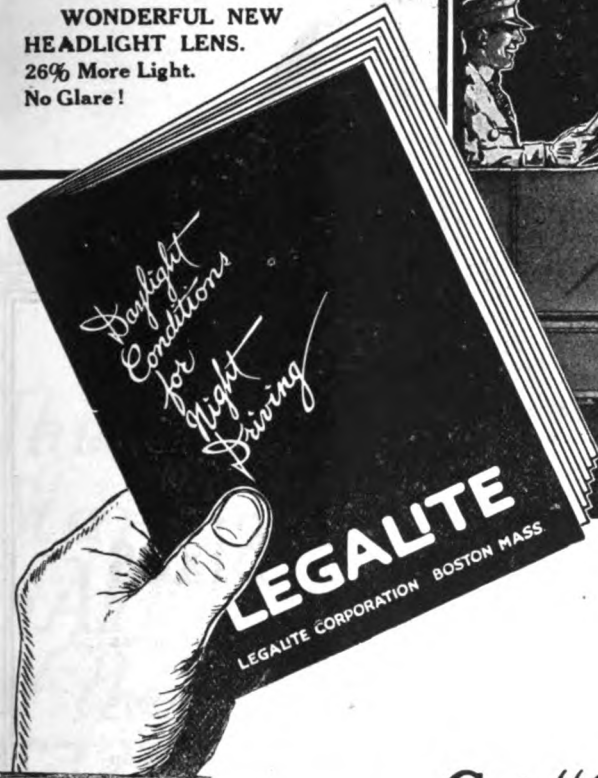
Michelin,
Milltown, N. J.

Send complete information
about your dealer proposition.

Name

Address

WONDERFUL NEW
HEADLIGHT LENS.
26% More Light.
No Glare!



FREE!

Send for This Book

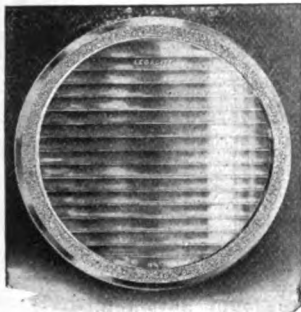
Get "26% More Light—No Glare"

Legalite is a new remarkable headlight lens. It throws no glare— you can stare into it without batting an eyelid! Yet it actually gives 26% more light than the ordinary lens. It fills a long felt need of the motorist—*really* fills it.

This free book tells all about Legalite. Read how, three months after Legalite was put on the market by a Massachusetts inventor, it literally revolutionized the headlight lens industry. Read why State and City Highway Commissions everywhere have approved it; why societies like the Safety First League of America have heartily approved it; why in a remarkable test conducted by the Mass. Auto Club, it was declared to be by far the best of 26 different headlight lenses tested. Read why

Kansas City, Washington, D. C., Philadelphia, Denver, Albany, as well as Police Departments everywhere heartily endorse it!

Such facts tell of themselves, how beneficial—how necessary—Legalite is. In 4 states and 29 cities, there are now stringent ordinances against blinding headlights. *Legalite complies with all these laws.* It throws a driving searching light 250 to 500 feet ahead. *But its rays keep to the ground.* They are never more than 3 1-2 feet above the ground. They don't shoot into the sky on an up-hill climb. And they cling to the ground on down-hill grades. Every depression, every irregularity in the road is shown up for what it is. Legalite, once for all, takes the danger out of night driving—makes night driving safe and pleasant.



The Secret

Note that Legalite Lenses are made of a combination of three distinct prisms. Legalite Lenses shoot the light *out and down*—not UP! That is why you get 26% More Light without the glare!

Dealers!

Write at once for Interesting Proposition.

LEGALITE

THE WONDERFUL NEW HEADLIGHT LENS

Every Monday morning you read in the paper of some tragic accident caused by the glaring headlights of an automobile. Some day your name may figure in such a story. If you use headlights that are considered so dangerous that they are prohibited by law in many places. Investigate Legalite—Some day it may save your life—or save you from maiming or killing a fellow-being.

Legalite is easy to put on—it comes in all sizes, for every style of lamp. It is very attractive in appearance, giving a handsome "cut-glass" effect to your headlights. Yet the outside is smooth glass, so that it catches no dust, and can be kept absolutely clean.

SEND FOR THIS FREE BOOK

You know how difficult and dangerous it is to drive a car in the night. A thousand times you have wished for a good headlight, that would make driving by night as safe as by day. Evidence

can be shown to you to prove that Legalite provides what you have always sought. Let us send you this booklet, "Daylight Conditions for Night Driving." It tells what Legalite is—by what a curious chance it was invented—and throws an altogether new light on the problem of night driving. Send for this book now. Tear out the coupon now and fill it in before you forget. Legalite is new but is gradually spreading throughout the country. Hundreds of dealers sell it. If your dealer does not yet carry them, send us his name.

LEGALITE CORPORATION

Dept. 156
120 Boylston St.
Boston, Mass.

Please send me your new free booklet, "Daylight Conditions for Night Driving."

Name.....

Address.....

Name of Dealer.....

Address.....

THE LEGALITE CORPORATION

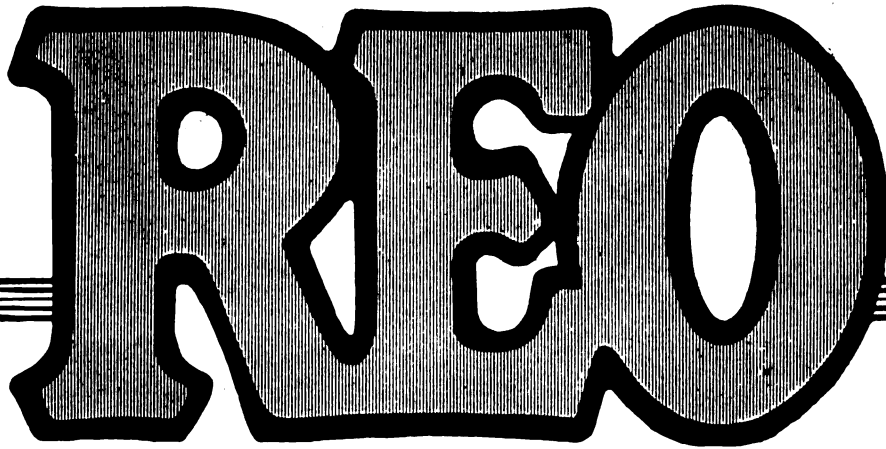
Dept. 156

120 BOYLSTON STREET

BOSTON, MASS.

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The "Gold Standard" of Sixes

RECENTLY A GROUP OF GENTLEMEN were discussing motor cars—as men so often do, since there's no topic, save baseball perhaps, that is of such general and such vital interest.

THEY WERE TALKING SIXES, pro and con, and "wondering whether" such and such Sixes were really good cars this year—in view of their past unsatisfactory records.

ONE SAID, "of all the Sixes made, there's just one you can tie to with certainty that it will live up to all expectations—because of its own and its maker's past record.

"THAT'S THE REO SIX"—the handsomest as well as the sturdiest Six made.

"IT'S THE GOLD STANDARD of Sixes."

"WE ARE ALL AGREED ON THAT, I guess," exclaimed another—"there never can be any doubt as to the quality of a Reo.

"REO CARS HAVE BEEN the 'Gold Standard' of automobile values since there were automobiles."

HAD YOU THOUGHT OF THAT—just in that way?

IF NOT, JUST CONSIDER for a moment the tremendous significance of that fact—for it is a fact that all motorists look upon Reo as the "Gold Standard."

YOU MAY DOUBT, you may question, claims made for other cars; but you accept as a fact firmly established, that a Reo is 24-karat fine from radiator cap to tire holder.

THAT BEING THE CASE, seems as if prudence dictates only one choice for your automobile—the one Six of which you can be absolutely sure—a Reo Six.

YOU CAN'T AFFORD—no matter what your income—you can't afford to experiment in so important a matter.

FOR IT ISN'T THE PRICE—goodness knows that is lower than anyone ever dreamed a first-class six-cylinder car could ever be bought for. It isn't the price that counts.

IT'S THE UPKEEP—cost of operation and maintenance; and the still more important fact that if the Six you buy fails to live up to the glowing praises of its makers your pleasure will be marred on every trip you take and as long as you own it. And the longer, the more unsatisfactory.

THAT'S WHAT COUNTS. If it proves to be a racing car—and therefore a "gasoline hog"; or so light it will soon show its flimsiness by squeaking and creaking and groaning over the least inequality of the road;

IF IT'S ONE OF THOSE "2 in 1" affairs that looks simple from the outside but proves as inaccessible as a burglar-proof safe when you try to make some adjustment or replacement or repairs;

IF IN FACT, IT FAILS to make good on any one of a hundred counts—then it falls short of the Reo Standard—and you will be grievously disappointed.

SO THE ONLY WAY to be absolutely certain that the coming year's motoring will be as pleasurable as you can desire, is to take no chances—choose the "Gold Standard" for yours.

UNALLOYED PLEASURE of ownership is assured when you select this car that all the world considers the "Gold Standard" in value at its price and in enduring qualities with the lowest depreciation from year to year—a Reo Six.

(143-A)

REO MOTOR CAR COMPANY Lansing, Mich.

(When Writing to Advertisers, Please Mention The Automobile Journal.)

*This Same
Stamina
in All Models
of the
STURDY
STUTZ*

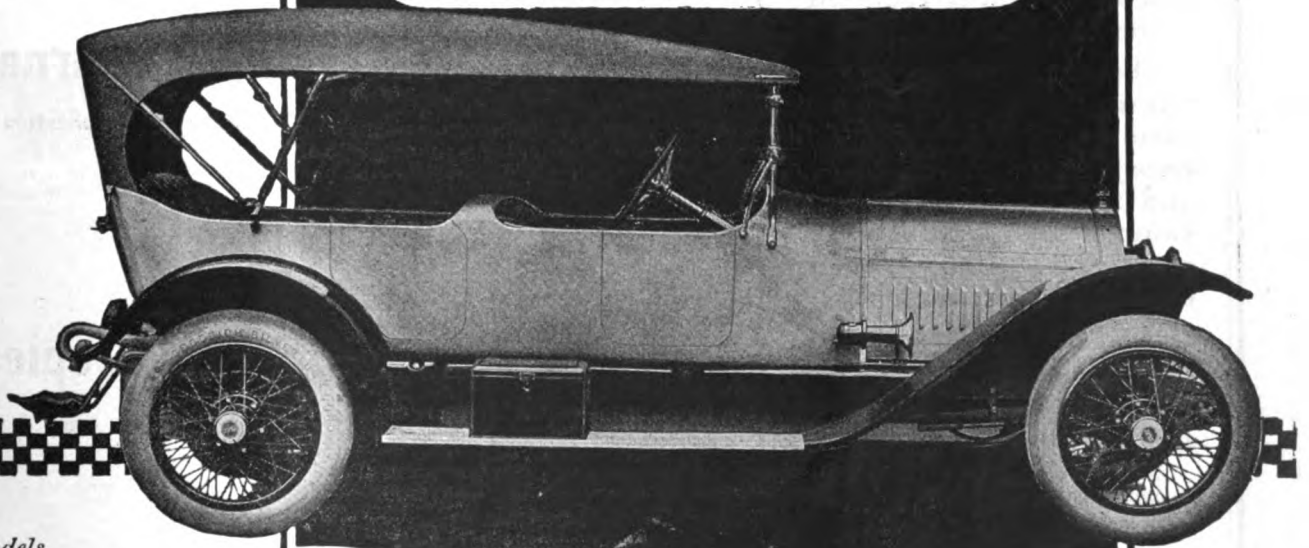


WORLD'S
Speedway Champion

WORLD'S
Road Race Champion

World's Long Distance
Records 250;300;350 mi.

World's Record for Consistency
4 Consecutive 1st & 2nds



Five Models
\$2,000—\$2,550

Literature on request

STUTZ MOTOR CAR CO.
Indianapolis

Indiana

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Entered as second class matter, April 15, 1906, at the Postoffice at Pawtucket, R. I., under Act of Congress of March 3, 1879.
VOL. XLII. JUNE 25, 1916. NO. 10.

TRADE MARK

EAGLEINE

REGISTERED

AUTO OILS



EAGLEINE OILS

are unequalled for motor lubrication, freer from carbon, economical because they protect the motor against mechanical wear, and the quantity required is comparatively small.

These are the claims of thousands of motorists,—some with years of experience,—who want full value, and more who know the value of high grade lubricants, and who know when they obtain satisfaction.

EAGLEINE QUALITY IS INSURED TO YOU

A grade for every type of motor.

It is sold in sealed containers

Let us send you our new book and chart. It is free at request.

EAGLE OIL AND SUPPLY CO.

44-45-46 India St., Boston, Mass.

NEW YORK CITY CHICAGO
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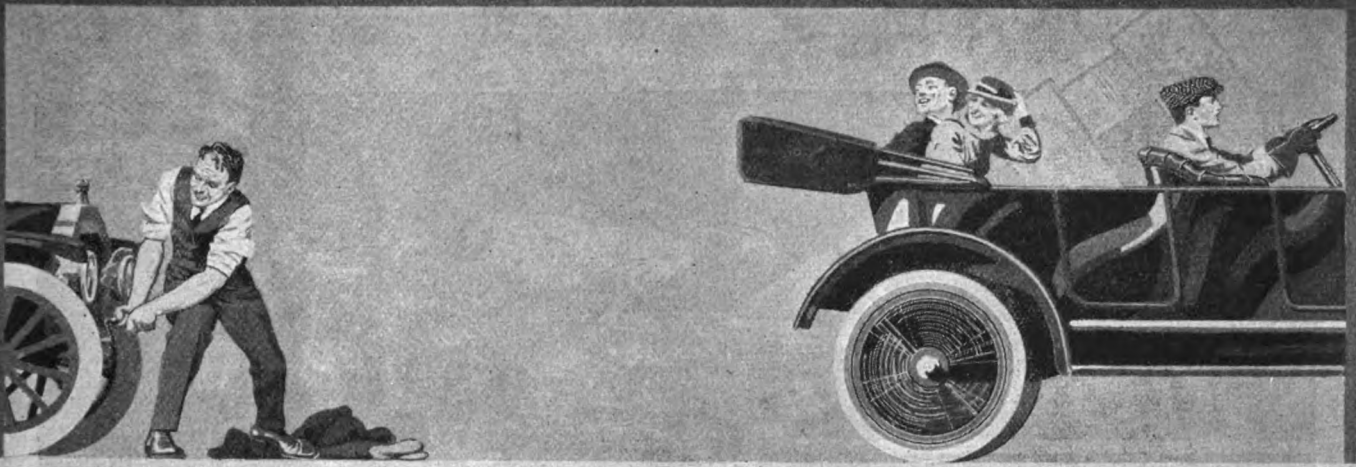
Accessory and Garage Journal

A Distinct Trade Publication

25,000 Copies

Each Monthly Issue

TIMES BUILDING
Pawtucket, R. I.



STARTS A FORD

A hinged-bracket to take up any play in the chain drive is a new development of the scientifically correct SPLITDORF-Apelco outfit. This important new feature, coupled with a wonderful "hand-ability" in installation and a freedom from interference with the FORD motor gives it the leadership.

SPLITDORF-Apelco Starter and Lighter for FORDS

The easy attachment of the SPLITDORF-Apelco unit to FORD cars, and its simple adjustment to the motor never handicaps any work being done around the FORD engine. Once installed the SPLITDORF-Apelco System never need be disturbed—it'll start and light **always** in **all** weathers.

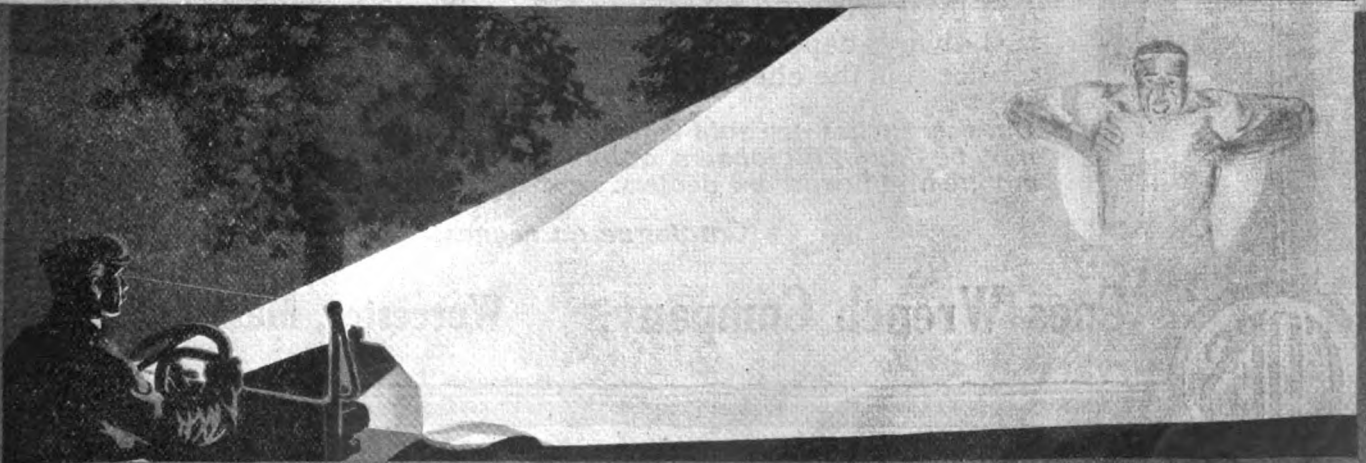
SPLITDORF ELECTRICAL COMPANY

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(All SPLITDORF features are fully covered by patent or patents pending)

LIGHTS A FORD





It's the same old COES

How often have you heard the repairman, machinist or shop manager say, "It's the same old Coes, just as good as the day I bought it—it will last forever."

That is evidence of the quality that has made Coes wrenches the standard the world over.

Coes Wrenches made today are just as good as the Coes Wrenches produced 50 years ago.

The material is selected with the same care, made by equally experienced and trained wrench makers, in a factory which specializes in wrench making. The wrenches are finished carefully and many times tested to assure the quality that will meet every requirement placed upon them.

Car owners who know wrench values demand the Coes. It is most popular with automobile repairmen, and in every other line of mechanical work Coes Wrenches will be found on the benches and in the tool kits of the expert workmen.

Coes wrenches can be had in just the size to fit any use. Any Coes will afford the same long and satisfactory service. It is always dependable and from the standpoint of wrench service it is the cheapest wrench produced.

Coes wrenches are sold wherever motor cars are used. They may be had of all jobbers, automobile supply houses, and automobile and hardware dealers.

Catalogue on request.



Coes Wrench Company, Worcester, Mass.



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RECENT PERFORMANCES OF CARS ON ROADS AND TRACK

which add to the prestige of the famous

AC

Cadillac Record

MAY 8-15, 1916

"Demon" Baker, accompanied by W. F. Sturm, of the Indianapolis News, drives a Cadillac Eight equipped with A C Titan plugs, from Los Angeles to New York, 3,471 miles, in 7 days, 11 hours, 52 minutes.

What Baker and Sturm say:

A C plugs never missed a shot in our record run; they deserve some of the credit for our record.

Spark Plugs

Hudson Record

MAY 2-3, 1916

Ralph Mulford, driving a Hudson "Super-Six" equipped with A C-Cico plugs, broke the world's record for 24 hours by covering 1,819 miles at the Sheephead Bay Speedway. The previous world's record was 1,581 miles.

On April 10th, at Daytona, Fla., Mulford made a speed of 102½ miles an hour with this car.

AC

Buick Record

APRIL 29TH, 1916

Joe Nikkrent and Earl Jackson smash California's greatest road record by driving a Buick Six equipped with A C Titan plugs from Los Angeles to San Francisco in 10 hours, 47 minutes, an average speed of over 43 miles an hour.

**These Records Were All Made with
Standard Cars Equipped with
STANDARD A C SPARK PLUGS**

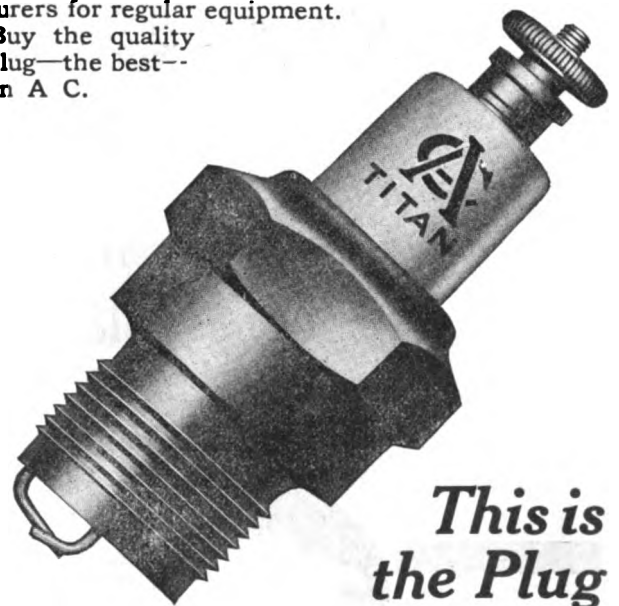
**These are the manufacturers
who equip with**

AC Spark Plugs

**No Greater Recommendation
Can Be Given a Spark Plug**

Packard	Bulck	Enger	Knox
Pierce-Arrow	Oakland	Glide	Lambert
Cadillac	Oldsmobile	Lexington-	Maxwell
Marmon	Stearns-	Howard	McLaughlin
Hudson	Knight	Austin	(Canada)
Chalmers	Saxon	Brockway	Mercer
Hupmobile	Stutz	Truck	Monroe
Chandler	National	Case Tractors	Pilot
Haynes	Velle	Chase Truck	Sayers
Chevrolet	Jackson	Daniels	Scovill
Dort	Apperson	Empire	Crane
Cole	Davis	Federal	Simplex
Dodge	Detroitter	G. M. C.	Singer
Brothers	Paterson	Gramm	Stephens
Reo	Moon	Trucks	United Truck
Palge	McFarlan	Jeffery	Wilcox Trux
Peerless	Westcott	Kissel Kar	Palmer-Moore

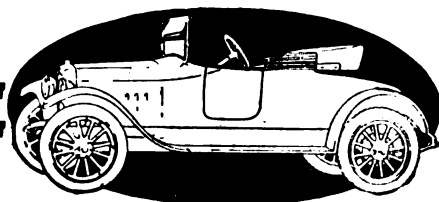
A C plugs have been used in making practically all World's Records. A C Plugs are selected by the best manufacturers for regular equipment. Buy the quality plug—the best—an A C.



*This is
the Plug*

Champion Ignition Company, Flint, Mich.

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Allen

Dealers Enjoy Immediate Deliveries

It is seldom that a dealer can get a combination of big value and quick delivery.

A big stock of materials and continued enlargement of our manufacturing facilities enables us to supply Allen dealers and to take proper care of new dealers in what is now open territory.

A big national advertising campaign is about to be put on, which will increase still more the popularity of Allen motor cars and the profits of Allen dealers.

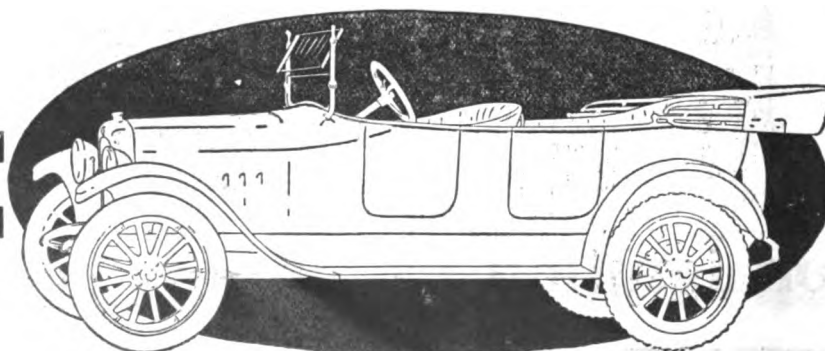
You will never regret investigating the Allen. It is a remarkable value and compares favorably with any car selling under \$1000. It makes a wonderful appeal to the buyer. It makes money for the dealer. It sells for

\$795

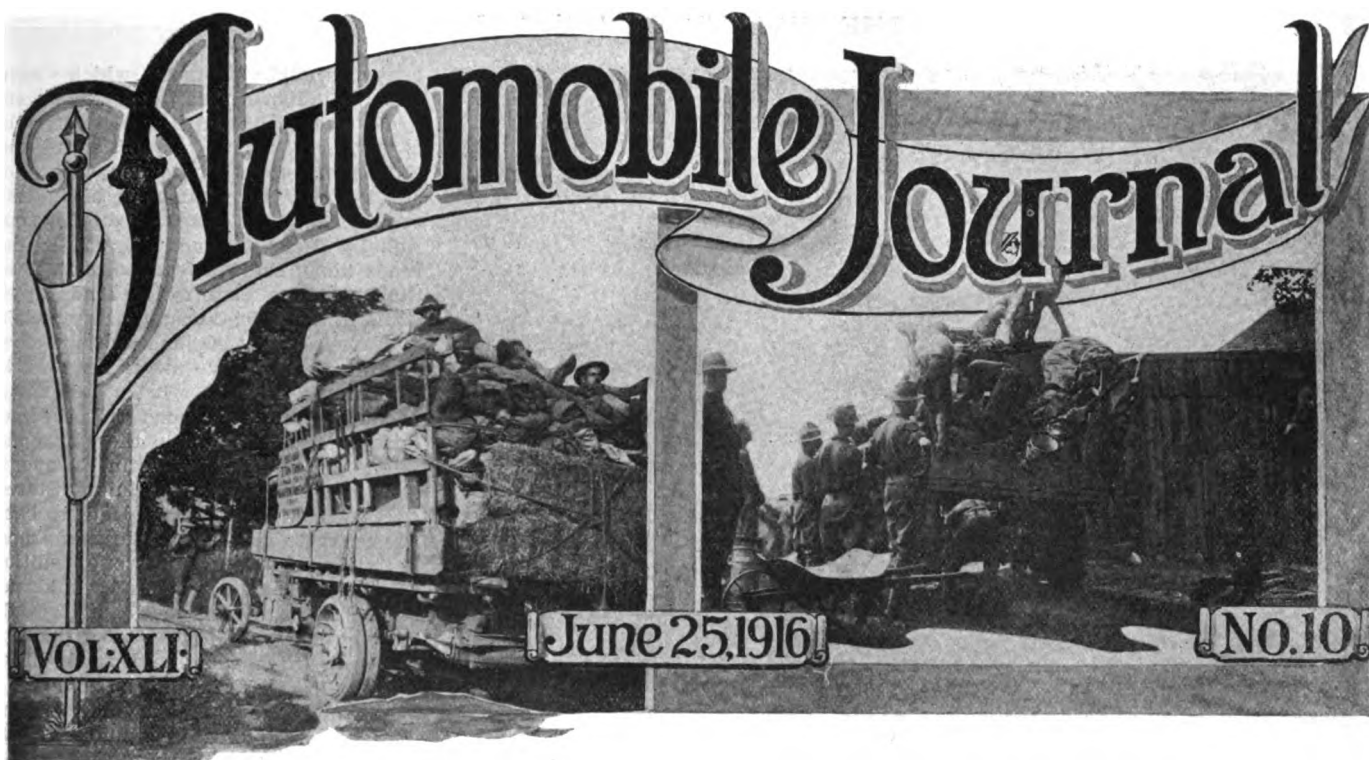
f. o. b. Fostoria

37-H. P. Motor - 112-inch Wheelbase - Weight 2300 lbs.

The Allen Motor Company
146 Allen Bldg., Fostoria, Ohio



(When Writing to Advertisers, Please Mention The Automobile Journal.)



Motorizing the United States Army.

THE most vivid imagination could not visualize the situation in the European theatre of war if 20th century inventions had been eliminated as factors in the battles. What the great struggle among the fighting nations would be without the use of the aeroplane, the Zeppelin or the motor car would be hard to conceive. In fact, there could have been no such gigantic war, as it was through these inventions that its enormous proportions were made possible. The aeroplane and the Zeppelin, of course, have been big factors, but their introduction being of a more recent date, and their functions being of a spectacular nature, their value and utility as adjuncts of war have become greatly exaggerated in the minds of the people. The motor car, or rather the gasoline driven truck, on the other hand, while given little publicity in the war bulletins, has been the one big silent factor that has made possible the great maelstroms of fighting millions.

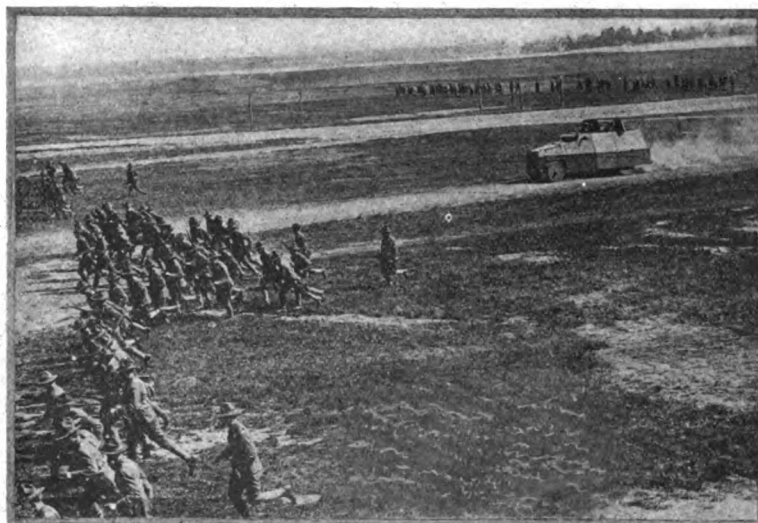
Upwards of 20,000,000 of men have been mobilized, fed and supplied with arms and ammunition through the agency of the motor truck, and this has been accomplished within the short period of two years. There were not enough horses in existence to have handled this enormous transportation problem, nor could there have been enough bred in that time to cope with the situation, as it takes from two to three years to produce a horse and then his efficiency for war purposes is about one-sixth that of a motor truck. There are many limitations to the service he renders; he cannot work 24 hours on a stretch and even in the eight or possibly nine hours that he can be worked he must be fed three times, whereas a motor truck will go continually 24 hours with a

delay of not more than 10 minutes for replenishing the gasoline supply.

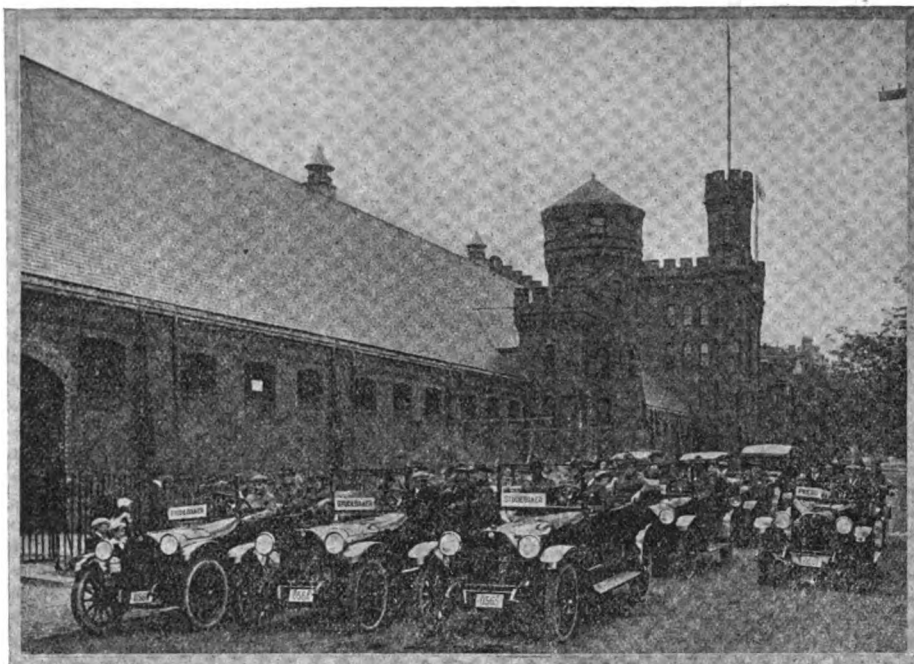
The motor truck up to the time of the great war had never been put to the final test for its utility and reliability, although in the less exacting occupation of serving commercial uses it had become established. Where hundreds had been used before thousands were put into use under every conceivable condition. The foreign manufacturers, although continually enlarging their plants, could not meet the war departments' demands for trucks and American manufacturers received orders that soon aggregated into the thousands.

Road conditions being favorable in Germany, France and Belgium, where the bulk of these trucks were put in service, the motor cars soon became the most important factor in the struggle, as they made possible an efficient commissariat. As Napoleon had stated long since, "an army travels on its belly." So it is today, the great generals, given the motor truck, immediately planned greater armies than had ever been mobilized before, as they had the transportation problem solved to the ultimate and minutest detail.

Prior to the outbreak of the war the American made truck was little known in European capitals, but soon after hostilities commenced and the military authorities realized that the motor vehicle was to entirely supplant the horse drawn method of transportation, agents were sent to this country to secure machines. At that time American manufacturers had not generally paid much attention to designing trucks for military purposes, but this fact made no difference to the foreign buyers. They took regular commercial chassis and put it to work with specially designed foreign



An Armored Motor Car Supporting an Infantry Charge.



Mobilizing the Massachusetts National Guard in a Test Run, Preparatory to the Call to Duty in Mexico.

military trucks. France was first to send to this country for trucks for military purposes and placed orders for several thousand. That these gave satisfaction is evident from the fact that other orders followed for thousands more and England and the other Allies came into the market here. The enormity of this demand is indicated by the facts that out of 60,000 trucks being used by the Allies nearly 25,000 are of American manufacture.

The imperative need of these trucks lead to ignoring types and requirements as specified by military authorities and every conceivable type of drive is represented in this vast collection of army transports. In the French service alone there are Whites, Packards, Saurer, Rikers, F. W. D.'s, Berliets, Clement-Bayard, Rochet-Schneider, Fiat and Delhay products, with a scattering of several American makes. No general defects or weaknesses developed in service of these trucks, although individually some of the machines, on account of their type of construction, were found difficult to repair and take care of owing to inaccessibility of the working parts. Automobile engineers who have been carefully watching the military trucks in operations have decided that certain features are required that are not essential when a machine is to be used for commercial purposes.

The lesson taught in Europe was soon grasped by the United States military authorities and at the outbreak of the Mexican trouble, army equipment was soon augmented with hundreds of motor trucks and old army mules and

heavy draught horses, which were thought indispensable, were almost entirely discarded. In the American field of military activity very different conditions had to be contended with. Instead of the long bands of bithulithic or macadamized roads stretching out radially for hundreds of miles, the roads along the Mexican border are of the average country byroad type, while in many instances routes are laid out over sandy fields and stretches where wheels leave deep furrows in their wake.

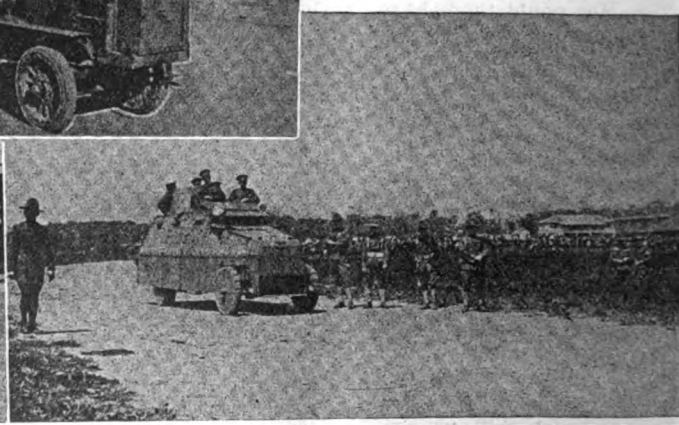
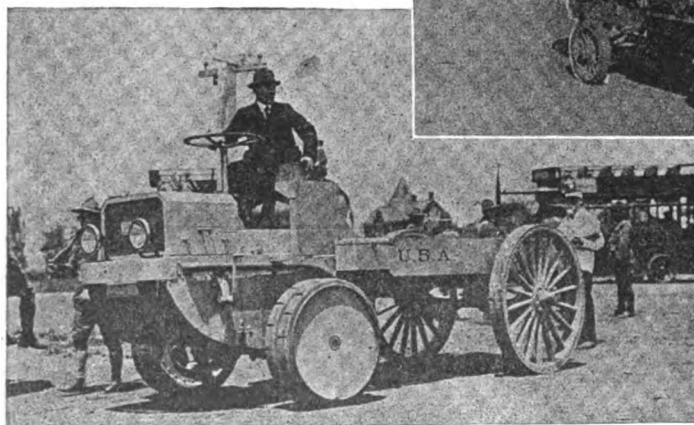
For the same reasons that the motor truck made possible the war operations on a gigantic scale in Europe, it also made possible the United States' operations in Mexico. Had it been necessary to use the old form of transportation on the punitive expedition into Mexico, the expense would not only have been enormous, but it would have probably lead to war with Mexico before this, had the United States been obliged to seize the railroads. That the motor truck saved the day was not due to any foresight on the part of the military authorities, but to the fact that American manufacturers to

meet the demand had a large production on hand and were in a position to immediately fill orders.

Requirements for Army Service.

The military authorities had held truck tests for the past 10 years to determine their serviceability for war purposes and they knew that their use was not experimental, although conditions required certain specifications in construction that differed from the majority of commercial vehicles manufactured. A good ground clearance and power applied to all four wheels have been found to be very desirable features in a military truck. Many minor features are also necessary, including short turning radius, standard tread, single tires, powerful brakes, large gasoline tank, forced feed water circulation and provisions in front and rear for towing purposes. Drain cocks on the radiator and water jackets of the motor and standardization of parts and accessories to make them interchangeable are also features, which together with those previously named were found to be advantageous during all the wars since the motor truck became a factor in transportation.

Having displaced the mule and the horse in army transportation the motor truck was naturally looked to for the performance of other duties and is now in service in many capacities. Two portable wireless stations mounted on trucks went with the punitive expedition into Mexico and there are now two portable machine shops in service and six others are being built. These shops, which are



Four Wheel Drive Tank Wagons in Service on the Mexican Border, at Top; New Type of Tractor Designed for Army Service, the Christie Front Wheel Drive Vehicle, at Left; Armored Mack Truck of New York Militia, at Right.

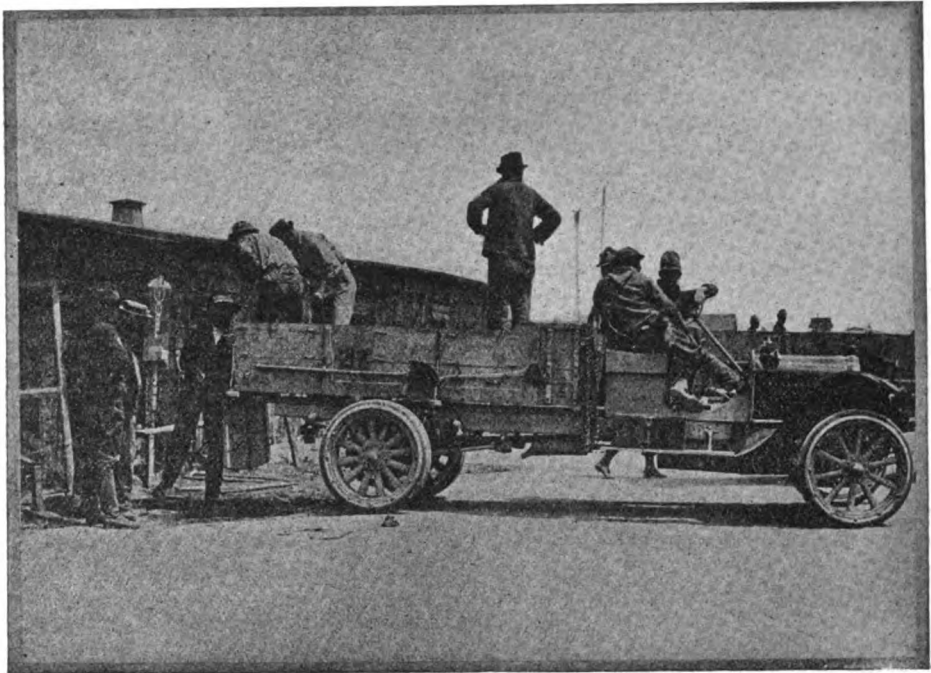
mounted on Four Wheel Drive trucks, are equipped with a 13-inch lathe with five-foot bed, drill press, grinder, portable drill, cabinet bench, three vises, a forge, three anvils, oxygen-acetylene welding outfit and a set of blacksmith, machinist and carpenter's tools. The power for the machinery is derived from a dynamo which is driven by a nine-horsepower, four-cylinder gasoline engine.

Two chassis types are being used by the government, the rear drive and the type that drives, brakes and steers on all four wheels. There are 172 of the latter type being used in Mexico and they have proven particularly efficient where poor roads have to be negotiated. Following the torrential rains in that section the roads at spots become mires and the heavily laden trucks need every possible bit of traction to make progress. For this reason the four-wheel drive has gained the confidence of the military authorities.

Much roadless country, which is tracked up with ruts and otherwise roughened, has to be traversed in war, and the going is anything but ideal for motor trucks. This service, however, has been the most strenuous the motor transport has ever been subjected to, and as a result the manufacturers are not only learning of any defects in their products, but it has stimulated the movement for better military roads. Preparations are already being made in Chicago for the shipment of enormous quantities of road building material to Columbus, N. M., where work has been begun on the construction of a 120-mile military road from that city to the United States army camp in Mexico. Motor trucks will also be used in this work, four tractors, four graders and 18 dump wagons, scrapers and other equipment having been shipped to Columbus.

Practically all the leading truck manufacturers in the United States have been called upon by the government for trucks for the Mexican service. The Packard company is now represented with 120 in active service on the border. Alvan Macauley, president of the company, following out his policy of preparedness, had a large number of bodies built up in advance to meet army specifications, so when last month the company received an order for 56 three-ton trucks, they were equipped and aboard train for San Antonio by 10:30 o'clock at night, eight hours after the order was received. This shipment alone was valued at \$186,425.

Recently a convoy of these trucks, which form the "Packard train No. 3," made up of 28 Packard vehicles, cut a full hour off the record between Casas Grandes, 104 miles across the border, and Columbus, N. M., making the trip in 10 hours' actual running time. The Packard worm type drive has given excellent results, as it is protected from the flinty sands that fly about the roads. There is also a fleet of 10 Packards being used at the United



Loading Ammunition on a White Army Transport at a Field Ordnance Store for a Run Across the Border.

States military training camp at Plattsburg, N. Y.

The F. W. D. truck, manufactured by the Four Wheel Drive Auto Company of Clintonville, Wis., is being used in the Mexican campaign and has given excellent service. They are equipped with large tanks for transporting water and gasoline and also carry portable machine shops. These trucks drive, brake and steer on all four wheels, making them extra serviceable for army work, particularly under the conditions found in Mexico. Recently the company received an additional order for 28 three-ton F. W. D. transport trucks and five additional 600-gallon tank trucks. It is claimed by the manufacturer that while the army authorities thought that anything heavier than a two-ton truck would not give efficient service, the four wheel drive truck, even though of a heavier type, can overcome the road conditions and can go anywhere that the lighter vehicle can. It is also claimed that where the road conditions are very bad the four wheel drive can make equal or better speed than the two-ton rear wheel drive.

Another large truck order was received by the Locomobile Company of America, which gave a demonstration of its Riker truck to the government officials several weeks ago and received an order for 30 three-ton of the vehicles. This was the first order given by the military officials for anything larger than a 2½-ton truck for service in Mexico.

Truck Uses Railroad Tracks.

The demonstration of the Riker-truck was unique. The wheels were fitted with a flanged rim device, invented and developed by A. L. Riker, vice president and chief engineer.



Riker Truck Equipped with Flanged Wheels for Operating on Railroad, Now in Use in Texas, at Top; Tuning up for Service at the Camp of the U. S. Army at Columbus, N. M., at Left; White Trucks Equipped with Tank Bodies for Transporting Water and Fuel from the Base at Columbus to General Pershing's Troops, at Right.

of the company. This equipment allows trucks to run along regulation railroad tracks. The machine was placed on the tracks at Columbus, N. M., and ran to El Paso, Tex., over the rails of the El Paso and Southwestern Railway system, making the trip of 93 miles at an average speed of 19 miles an hour. Upon arriving at El Paso it was derailed and driven to a hotel, where General Scott was stopping. It made a return trip to Columbus the same day.

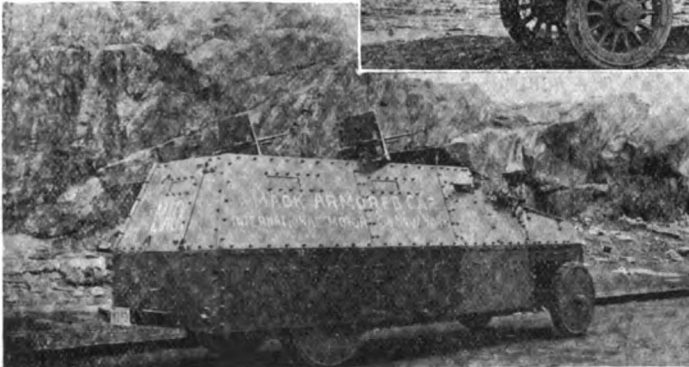
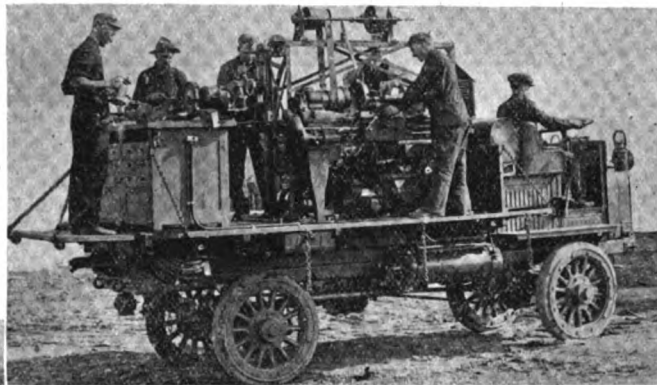
Armored motor trucks, carrying rapid firing guns, have been utilized as far back as the Boer war and are now being used in Europe, but so far the United States has not put any in service in Mexico. Several armor manufacturers in this country have built armored bodies to go on trucks and there are a number being demonstrated. The armored truck presented several difficulties. The earlier ones were not heavily enough armored to resist the high velocity rifle bullets and so were practically useless, while later designs with extra heavy armor overloaded the chassis to such an extent that they could only be serviceable under excellent road conditions.

It is highly probable now that the New York National Guard has been called out that an American made armored truck will figure in the fighting in Mexico. The New York organization already has its first unit of a 40-vehicle battery, which was provided through subscription by patriotic New York citizens. The car now in use by the militia of that state is a two-ton Mack chassis with armored body. It is designed to carry two rapid fire guns, ammunition and a crew of gunners. The armor is of special heat treated steel and deflects the bullet of the regulation U. S. army rifle fired from a distance of 50

not only serviceable in going over the treacherous mountain trails, but also can cross the open spaces and make turnouts off the roads where it is necessary to pass the moving troops or truck convoys.

The heavier type of pleasure vehicle, it is expected, will serve its best purpose as a unit of defense where it can be operated over the good roads in the different states for mobilization and shifting troops from one zone to another where railroad facilities are inadequate. Tests for the use of the pleasure car for this purpose have already been made by both the regular army and the militia organizations of the various states. The regular army, during recent troop manoeuvres in California, used them to transport a large body of U. S. infantry, together with a complement of heavy field artillery from San Francisco to Half Moon bay, an unprotected inlet on the Pacific Coast. This expedition was taken from the one point to the other in record time, and the results were looked upon by the military authorities as confirming the value of the pleasure car in manoeuvring troops. These manoeuvres were carried out under the plans of General William L. Sibert of the U. S. Army, and Major H. D. Russ of the Oldsmobile Company of California. A large fleet of Oldsmobile touring cars were used in the experiment.

A similar test was also held in Massachusetts, in which Company D of the Ninth regiment of militia participated. The plan of campaign called for the sudden rush of a company of troops from Boston to Hingham to protect the military and naval stores at the latter place. The test was carried out under the direction of Captain Herbert M. Layden of the Ninth regi-



Four Wheel Drive Truck Equipped with Machine Shop for Service in Mexico, at Top; Mack Armored Truck Owned by the New York National Guard Battery, Left; Saurer Truck Transporting Field Gun for California Militia.

yards. This car weighs 9052 pounds, with equipment, and is of a compromise type as compared with those tested out in Europe.

These machines are considered most efficient in repelling attack by air and hindering the advance of an enemy at the start of an engagement. They are capable of quick reconnoitering and can deliver very effective fire, as the trouble with the rapid fire guns in hindering an advance has been that after they have done their work they are in danger of being rendered useless unless an easy method of transporting them is at hand. The development of this type of vehicle was done under the direction of Captain H. G. Montgomery, who will command the New York battery. The designing and construction of the cars has been placed in the hands of the International Motor Truck Company, which is prepared to build them on short notice.

To what extent the pleasure car will figure in case of a war with Mexico is highly problematical. The lighter cars, including Fords, Maxwells and other makes, are now being used by officers at the army posts along the border and in actual service with the punitive expedition.

Owing to road conditions the officers in action find the small light cars easy to get around in, besides being more economical and entailing less time and care. These cars are

ment, with the co-operation of G. N. Jordan, manager of the Studebaker Boston branch, who furnished a fleet of 18 Studebaker touring cars. Two commercial cars were also used to transport ammunition and supplies.

At the end of the test Captain Layden said that it proved conclusively the superiority of moving troops in case of an emergency. "There is no question," he said, "but that, should it be necessary to move armies to the front in case of sudden attack, the pleasure cars and motor vehicles could be used to the greatest advantage. No better preparedness measure could possibly be adopted than the formation of a motor car battalion composed of privately owned automobiles. The manoeuvres have also proven that the militiamen can be carried from their headquarters to points of military importance with greater speed and certainty in motor cars than by any other method."

When the troops were first sent to Mexico the White company received an order for a train load of trucks to be used as supply and baggage carriers and later delivered five water and gasoline tank trucks to the government. This latter consignment had been built for the Standard Oil Company, but owing to the urgency of military needs they were released to the government.

S. A. E. MAY ADOPT NEW NAME.

During Cruise Proposal Is Made to Enlarge Membership and Activities of the Society.

A plan to add the members of the Tractor, Marine, Aeronautical and Stationary Gas Engine engineering bodies to the membership of the Society of Automobile Engineers was the feature announcement on the second annual cruise of the S. A. E., held on the Great Lakes during the week of June 12. There were more than 540 members of the S. A. E., together with their wives and friends, on the steamer Noronic when it left Detroit.

While pleasure is always combined with business on the S. A. E. outings, the members lost no time in getting down to work, a meeting of the Standards Committee being called to make their reports, which were accepted for submission to the members of the society after the various points had been debated.

After the recommendations of the Ball and Roller Bearings Division was accepted reports were heard from the Car-buretor Fittings Division, which had been working on throttle lever throws, and from the Electrical Equipment Divisions, which recommended that lamps should be placed at least three feet above the ground. This latter recommendation was readily accepted by the

Standards Committee and a standard head lamp bracket in three sizes was adopted. The same committee gave the opinion that devices for focusing lamp

bulbs should not rotate the bulb, as it would move the filament out of focus line and recommended that dimming devices which operate by reducing the current should not be employed. A revision of charging receptacles was reported by the Electric Vehicle Division.

The Nomenclature Division report included an authorized glossary of all the terms to be applied to the different parts of an automobile and of terms used in the trade. After the acceptance of this report the Iron and Steel and Miscellaneous Divisions reported.

President Russel Huff in his address at the business session announced the plan for the expansion of the organization by taking in members of engineering organizations in allied lines. He said that the new organizations, after becoming a part of the S. A. E., will be represented by four new vice presidents and have members on the Council and Standards committees.

The treasurer's report for the eight months of the present fiscal year showed receipts of \$75,441.65, and expenditures of \$36,072.96, leaving a balance, including the amount carried over from last year, of \$47,901.96. A total membership of 1910 was reported, with 66 applica-

tions to be acted upon. During the year 113 members and 25 students were added.

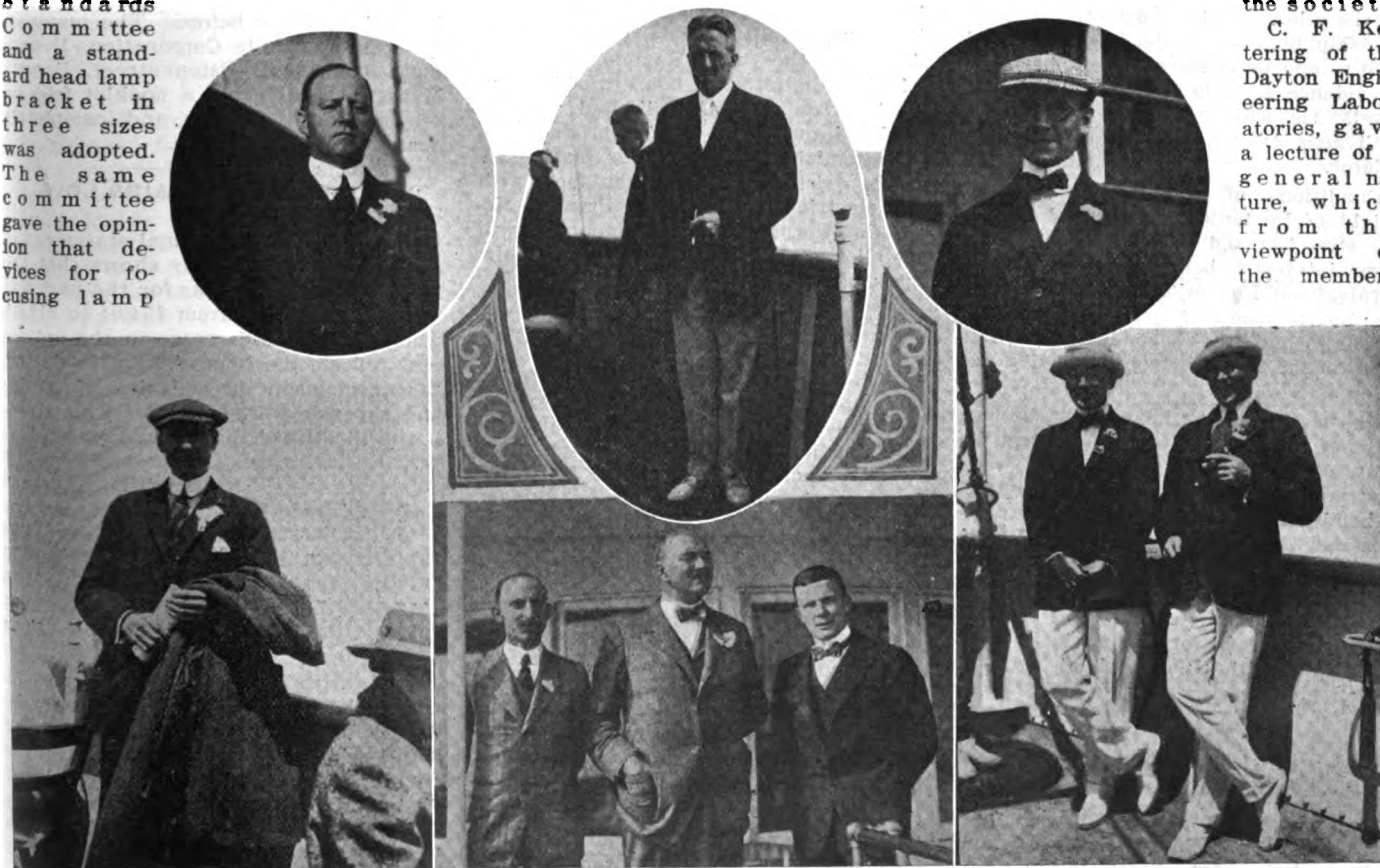
After a spirited discussion as to the proper method of selecting a nominating committee the question was laid on the table for consideration at a future meeting and the nominating committee for this year was organized by electing one member from each section, with two members at large who are not affiliated with any section.

The following were elected: K. W. Zimmerscheid, Detroit section; A. C. Bergmann, Metropolitan section; C. S. Pelton, Cleveland section; F. E. Place, Mid-West section; E. S. Foljambe, Pennsylvania section; D. P. Dorris and David Ferguson. The election will not take place until next winter, but it was reported that George H. Dunham, the Detroit consulting engineer, will be the candidate for president; J. G. Vincent, vice president, and F. E. Moscovics and B. B. Bachman, members of the council.

Before the business meeting it was announced that the council had elected K. W. Zimmerscheid a life member of the S. A. E., in recognition of the valuable services he had rendered in behalf of the organization. The recipient of the honor has distinguished himself as chairman of the Standards committee, particularly through diplomatic work, he having been instrumental in securing recognition of the standards of the society from the manufacturers. He also took care of a great deal of the detail work that made possible the success of

the society.

C. F. Kettering of the Dayton Engineering Laboratories, gave a lecture of a general nature, which from the viewpoint of the members



Some of the Prominent Men Participating in the S. A. E. Mid-Summer Cruise—Upper Left, Arthur J. Slade, Consulting Engineer; Upper Centre, George W. Dunham, Consulting Engineer, Nominee for Next President of the Society; Upper Right, Russel Huff, President of the Association; Lower Left, H. E. Coffin; Lower Centre, Left to Right, Lieutenant R. T. Yong, Henry Souther and Dr. H. C. Dickinson; Lower Right, R. M. Owen and R. R. Owen of R. M. Owen & Co.

proved to be the most interesting and entertaining of any they had listened to since the organization of the society. Mr. Kettering used experiments with liquid air, high frequency currents, radium and other unusual elements to illustrate his talk. He performed a number of operations with his paraphernalia that 10 years ago would have been considered miraculous. He spoke of the manner in which the discovery of one new product would create an entirely new industry and would greatly affect the older industries. In this connection he exhibited a billiard ball which had far greater resiliency than the ivory ball and said that its composition was discovered through research work during the development of the Hyatt bearing and also through the possibilities seen in the product called Bakelite, which is composed of phenol and formaldehyde.

At the professional session Prof. Galup read a paper on "Car Performance," after which a written discussion by John Younger, chief engineer of the Pierce-Arrow Motor Car Company, was read. The principal feature of his paper was in the form of a formula for rating car performance, Mr. Younger making a plea for the consideration of more than mechanical details in rating car performance for the purchaser and owner.

RESTA AT NARRAGANSETT PARK.

Dario Resta, who has a large lead over all the other speedway drivers for championship honors for the year, is scheduled to appear at Narragansett parkway, Providence, R. I., in an earth and air carnival. He will race a one-mile match with Jean Domenjos, the loop the loop aviator.

Conditions of the race restrict the height of Domenjos' flight to 10 feet on the stretches and 50 feet on the turns. Great interest is being manifested in the carnival, as Domenjos is the holder of the South American trick flying championship and the second European to perform the loop the loop in a flying machine.

The meet is being held under the auspices of the Providence Aeronautical Society, of which F. M. Mansfield is president and chairman of the contest board. A bomb dropping contest is also to be held and the amateur aviators of Rhode Island have been invited to enter into competition with Domenjos.

The proceeds of the meet will be used to starting a fund for the purchase of an aeroplane for the Rhode Island National Guard.

ELGIN ROAD RACE.

The promise of a large field of star drivers for the Elgin national road race at Elgin, Ill., assures one of the most interesting contests ever held over the course. Negotiations to secure the financial success of the event are still pending.

MAGNETIC GEAR SHIFT STANDARD.

Cutler-Hammer Equipment Will Be Installed in the New Premier Cars—Many Inquiries About System.

The electric starter came into vogue several years ago and at first met with the usual opposition that any improvement to the motor car has had to contend with, but it survived and is today a part of the equipment of high class automobiles. Any manufacturer of a high priced product who attempted to market his car without this device would be looked upon as being passe.

Now comes the magnetic gear shift, which seems to be the next most important development in motor car design. This is not a new device. The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has been manufacturing a magnetic gear shift for several years and it has been used with satisfaction on hundreds of motor cars. Although its merits are acknowledged, it seems that before it becomes generally used it must be almost unanimously demanded by the motor car users.

The Cutler-Hammer company has received over 13,000 inquiries from motor car buyers throughout the United States in the past month about their electric gear shift. This interest in the device would indicate alone that there is a large demand for a substitute for the lever system of changing gears. As to its serviceability there remains little doubt, as the Cutler-Hammer company, which is the foremost concern of its kind in America, give an unlimited and unqualified guarantee on their product.

Recognizing the enormous market already existing for cars equipped with the electric gear shift, the Premier Motor Car Corporation of Indianapolis will install it as part of the regular equipment in the new Premier this year.

LEGALITE HEADLIGHT LENS.

In the past few years no less than five states and 19 cities have passed laws and ordinances governing the use of automobile headlights. The idea is spreading rapidly among the states and is receiving attention by an increasing number of legislatures, and it requires no "seventh son of a seventh son" to prophecy that in a few years blinding headlights, which have been the cause of so many tragic accidents in the past, will be eliminated from the highways of this country.

Naturally, with the passage of so many regulatory laws, illuminating engineers have been busy providing headlights that will meet all the requirements. As a general rule the laws specify broadly that headlights shall not be "glaring" or "dazzling," and that the light shall not be projected at height greater than 4½ feet from the ground.

A number of devices have been invented to meet these conditions, many of them having a disadvantage, however, of

producing insufficient light, which in the opinion of many motorists is quite as conducive to accident as the "glare" evil.

In the last few months, however, there has come into prominence in the East a really remarkable headlight lens that throws no glare at all and yet—contradictory as it may seem—gives 26 per cent. more light. It is a multiple prism lens, called Legalite, and is the result of a chance discovery.

The main principle of construction in the Legalite is that the lens consists of several types of prisms. Because of this the light is not diffused—in other words, gives no "glare." Instead, the beam is sent downward and ahead, across the whole road. It has been shown by tests that Legalite throws a driving light from 350 to 500 feet ahead, and yet the light is at no point more than 4½ feet off the ground.

Some remarkable tests have been made with this new headlight lens. The manufacturer relates as an illustration that the Massachusetts Automobile Club at a recent illumination test selected Legalite as the best headlight out of the 26 different lenses tested; that the New Jersey commission has done the same, and dozens of cities have followed suit; that motor clubs have indorsed it; the Safety First League has put their seal of approval on it.

It appears from the record of this up-to-date headlight that the great problem of safe night driving is at last solved. Safety to the driver, as well as to pedestrians and drivers of other cars, is insured as never before. The manufacturer, the Legalite Corporation, Department 156, 120 Boylston street, Boston, Mass., is sending out a booklet free on request, which clearly and completely describes Legalite lenses.

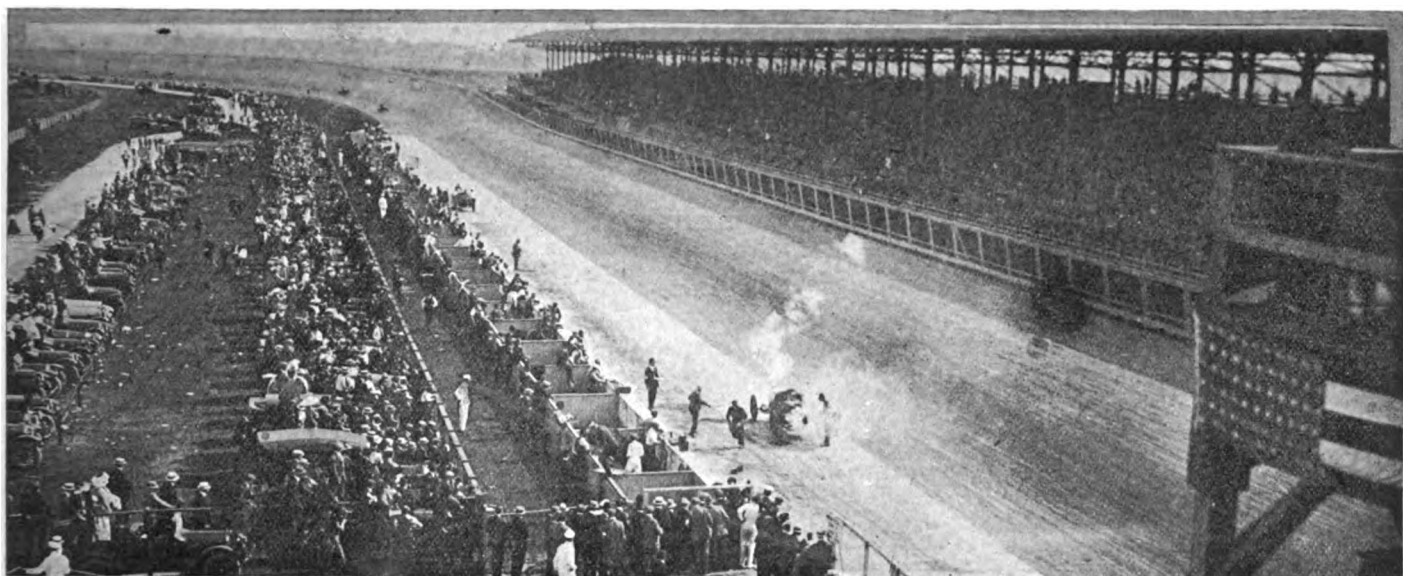
STUDEBAKER REPAIRS LOW.

An analysis of the annual statement of the Studebaker company shows that the value of repairs per car for the past five years has declined from \$54.04 to \$11.04. This remarkable decrease in the upkeep cost reflects the improvement in design, the development of materials, formulae and superior workmanship. This showing is illustrated in the following table:

Year	Cars in Use	Repair Part Sales	Average Per Car
1915.....	192,225	\$3,121,966	\$11.04
1914.....	145,380	2,438,873	16.77
1913.....	109,920	2,524,089	22.96
1912.....	74,510	2,228,786	29.91
1911.....	45,987	2,485,172	54.04

The earliest figure of repair sales includes the building up of inventories by dealers, and, therefore, the figure of \$54.04 per car is artificially high, but the trend is unmistakable. Studebaker dealers are accustomed to carry between \$1,500,000 and \$2,000,000 of supplies on hand.

Gross sales of the Studebaker Corporation in 1915 were \$56,539,006, so that the repair parts business of \$3,121,966 was 5.5 per cent. of the total.



RESTA ESTABLISHES RECORD AT CHICAGO.

Following so close upon his decisive victory at Indianapolis, Dario Resta in winning the Chicago race over the Maywood course, June 11, not only placed himself first in the eyes of the auto race fans, but added another wreath of laurels to his long list of speedway conquests. He also established a new world's record for the distance of 300 miles, averaging 98.7 miles per hour, the elapsed time being 3 hours, 2 minutes and 31.64 seconds. Last year over the same course he won the race and set a new world's record for 500 miles of 97.58 miles per hour.

Many old timers who sat in the boxes pronounced the contest the most fascinating ever held in America. It certainly outclassed anything ever held at Indianapolis and in comparison all the previous classics at Chicago were tame. Resta seemed mad and heedless of all danger in rounding the turns, and as though fully confident from his previous successes on the Chicago track, he showed all the power his car could develop whenever he entered the stretches. Taking the initiative in this manner proved heart breaking to the rest of the field, except De Palma, who had frequent brushes with Resta.

There was only one incident in the great race that dimmed the brilliancy of Resta's victory, and this occurred in the shape of an accident to De Palma's Mercedes, putting the latter a full lap behind at a time when he was running neck and neck with the victor. The race was one

of the most daring and spectacular in the history of the sport and barring the incident which probably cost De Palma the race, would have furnished one of the closest contests on record.

How De Palma Lost Race.

De Palma's trouble developed on next to the last lap, when he was forced to stop to replace a blown out plug. He lost but a few seconds in the pit, but at this juncture in the race the delay proved serious and he crossed the finish line less than two minutes after Resta, his time being 3:04:25:37, at the rate of 97.60 miles per hour. His car was reputed to be faster than Resta's Peugeot and it was the general opinion about the track that he was to be the winner up to the time of the accident. Throughout the race De Palma had employed remarkable strategy and was driving hub to hub with the winner. He was visibly affected at the end of the contest, as his bad luck had cost him not only the honors of victory, but \$6000 in prize money.

Josef Christiaens, driving a Sunbeam, was the third home, crossing the finish line three minutes and 30 seconds behind De Palma, after driving a very consistent race. He maintained a steady pace throughout the contest, but did not attempt to brush the leaders by any hair raising or spectacular spurts even on the stretches.

Thirty-five seconds behind Christiaens, Eddie O'Donnell with his 16-valve Duesenberg crossed the tape, bringing home the first American car. Much credit was

given O'Donnell for his performance, as he had made five stops, four times going to the pit for tire changes and once for oil and motor adjustment. Although being hopelessly out of the race for leading honors he continued to do his share toward making the contest a fast and spectacular one by making sensational bursts of speed past Resta and De Palma during the last few laps.

Galvin brought the other Sunbeam in the money, in fifth place, nearly two minutes behind O'Donnell, although he had only stopped to replace one tire and replenish his gas supply.

Ira Vail, driving a Hudson, took sixth money and made an average speed of 94.48 miles per hour. Vail's car was the same reconstructed model with which he took third place at the Sheepshead Bay race. A feature of his performance was the remarkable get-aways he made from the pit, having a self-starter on his "Super-Six," which is a semi-stock model.

The others who won prizes finished in the following order: D'Alene, Duesenberg; Gable, Burman Special; McCarthy, Hudson and Dave Lewis in a Crawford Special. George Buzane, in a Duesenberg, was the last man to finish. His elapsed time was 3:37:29.50, or at an average speed of 87.56 miles per hour, or 11.05 miles less per hour than Resta's rate.

Art Johnson, driving a Crawford Special, and Otto Henning, in an Ogren, were flagged, the former in the 145th lap and

ELAPSED TIME AT VARIOUS STAGES OF THE RACE.

Finish No.	Car	Driver	20 Miles	100 Miles	200 Miles	300 Miles	M.P.H.	Prizes
1.....	21—Peugeot	Resta	12:09	59:34	2:02:16	3:02:31.64	98.61	\$13,000
2.....	22—Mercedes	De Palma	12:11	1:00:43	2:02:17	3:04:25:37	97.60	6,500
3.....	29—Sunbeam	Christiaens	12:25	1:02:04	2:04:48	3:07:55.48	95.78	3,000
4.....	8—Duesenberg	O'Donnell	12:11	1:02:38	2:06:45	3:08:30.46	95.48	1,500
5.....	16—Sunbeam	Galvin	12:40	1:02:05	2:07:32	3:10:23.45	94.54	1,300
6.....	24—Hudson	Vail	12:48	1:03:25	2:07:10	3:10:30.65	94.48	1,200
7.....	18—Duesenberg	D'Alene	13:26	1:01:54	2:08:25	3:13:02.85	93.24	1,100
8.....	4—Burman Special	Gable	12:48	1:03:59	2:06:26	3:15:51.31	91.90	900
9.....	14—Hudson	McCarthy	12:51	1:07:40	2:12:55	3:19:10.73	90.38	800
10.....	26—Crawford Special	Lewis	14:00	1:06:32	2:09:40	3:24:58.07	88.63	700

EQUIPMENT AND CHASSIS DETAILS OF CONTESTING CARS.

Driver	Car	Bore and Stroke	Cyl. Disp.	Carb.	Mag.	Plugs	W. B.	Oil	Wheels	Tires
Resta	Peugeot	3.70x6.65	4 224.3	Miller	Bosch	K. L. G.	106	Dixon's	Rudge	Silvertown
De Palma	Mercedes	3.70x6.49	4 178.0	Mercedes	Bosch	Rajah	112	Monogram	Rudge	Silvertown
Christlaens	Sunbeam	3.21x6.14	6 299.8	Miller	Bosch	K. L. G.	106	Castorol	Rudge	Silvertown
O'Donnell	Duesenberg	3.75x6.75	4 298.2	Miller	Bosch	Rajah	106	Oilzum	Rudge	Silvertown
Galvin	Sunbeam	3.21x6.14	6 299.8	Miller	Bosch	Rajah	106	Castorol	Rudge	Silvertown
Vall	Hudson	3.50x5.00	6 288.6	Hudson	Delco	Rajah	105	Veedol	Rudge	Silvertown
D'Alene	Duesenberg	3.75x6.75	4 298.2	Miller	Bosch	Rajah	106	Oilzum	Rudge	Silvertown
Gable	Burman	3.63x7.93	4 279.8	Miller	Bosch	K. L. G.	104	Castorol	Rudge	Silvertown
McCarthy	Hudson	3.75x6.75	6 288.7	Hudson	Delco	Rajah	102	Castorol	Rudge	Silvertown
Lewis	Crawford	3.75x6.75	4 298.0	Miller	Bosch	Rajah	106	Oilzum	Rudge	Nassau
Buzane	Duesenberg	3.98x6.00	4 300.0	Miller	Bosch	Rajah	106	Oilzum	Rudge	Silvertown
Rickenbacher	Peugeot	3.74x6.65	4 292.6	Miller	Bosch	Rajah	106	Castorol	Rudge	Silvertown
Oldfield	Delage	3.74x6.29	4 275.0	Miller	Bosch	Rajah	104	Oilzum	Rudge	Firestone
Alley	Kline Special	3.98x6.00	4 300.0	Miller	Bosch	Rajah	102	Monogram	Rudge	Silvertown
Kline	Kline Special	3.98x6.00	4 300.0	Miller	Bosch	Rajah	106	Monogram	Rudge	Silvertown
Henning	Ogren	3.98x6.00	4 300.0	Miller	Bosch	Rajah	106	Castorol	Houk	Nassau
Johnson	Crawford	3.75x6.75	4 298.2	Miller	Bosch	Rajah	106	Castorol	Rudge	Nassau
Haibe	Ostewig	4.34x5.00	4 296.0	Miller	Bosch	Answer	102	Oilzum	Houk	Silvertown
Thompson	Olson Special	3.50x5.00	4 192.4	Miller	Bosch	Rajah	108	Sexton	Rudge	Silvertown
Watson	J. J. R.	3.75x6.75	4 298.2	H. & N.	Bosch	Rajah	101	Oilzum	Rudge	Silvertown
Rawlings	West Duluth	3.75x6.75	4 298.2	Miller	Bosch	Rajah	106	Castor-Sexton	Rudge	Silvertown

All cars but the Mercedes were equipped with Hartford shock absorbers, and Boyce Motometers were used on all but D'Alene's, Duesenberg and the West Duluth car.

the latter on the 123rd lap. All the other starters were eliminated through accidents or engine trouble except Alley, whose Klein Special was disqualified for smoking on the fifth lap.

Accidents Were Few.

The slogan of "safety first," a peculiar one for such a hazardous contest, was probably responsible for the remarkably few accidents. In fact, there were only two that appeared serious, but through presence of mind the drivers averted disaster. Christlaens' team mate, Frank Galvin, in a Sunbeam, after crossing the wire at the finish blew a tire on the first curve, crashed into the retaining wall and broke down the heavy posts and beams of which it is constructed. Through marvelously quick and nervy work he got his direction again on the track and saved both himself and Bill Skall from injury. The other accident, which threatened a bad spill, happened to Otto Henning when he blew a tire on one of the turns. After making a quick skid, however, he regained control of his car and went to the pit.

Spectators Were Disappointed.

From the spectators' point of view there were two disappointments. The first one came when the popular idol, Barney Oldfield, stopped on the ninth lap at the pit, where it was learned that his Delage was out of commission with engine trouble. Being his last appearance in the speedway classics, it was also a bitter disappointment to him.

The elimination of another favorite, Eddie Rickenbacher's Peugeot, on the 61st lap, was another disappointment, as he was driving to win from the start. Before a broken valve sent him to the pit he was travelling with the throttle wide open in an attempt to set the pace for Resta.

Throughout the last 100 miles of the race De Palma raced almost within reach of his only opponent, Resta, at times taking a slight lead and then surrendering it by but a few yards. During the first 50 miles the pace was fast and furious, Rickenbacher, Resta and De Palma averaging 99 miles an hour, while in the second 50 miles the two latter drivers increased their speed, lifting

the average to over 100 miles an hour.

An analysis of this marvelous speed contest of mechanical steeds showed that the cars themselves, so far as the reliability of the power is concerned, are wonderfully reliant, but that the accessory and equipment used in these severe tests of endurance are not so highly developed to stand the wear and tear as the fundamental and main parts of the cars.

Sixty-eight stops in all were made at the pits by the 21 cars, and were necessitated by similar causes as in previous contests. Tire trouble was quite prevalent, due possibly to the fact that the track is older and weather roughened. In all 29 tires were changed, 17 right rears, eight left rears and four right fronts. Six stops were caused by plug trouble and eight stops made for gas and 14 stops for motor adjustments.

Time Lost at Pits.

Much time was lost by the inexperienced drivers in making the pits on these stops, several going by so far they were obliged to make a complete circuit of the track to get in, while a number applied their brakes so as to skid a considerable distance by their pits and were

obliged to back in. In comparison, Resta's only stop was a masterpiece, he going into the pit accurately and coming out two minutes later with a new right rear tire, radiator filled and oil and gasoline supply replenished. De Palma made two stops at the pits, the first time for a new left rear tire and some gas, both operations being completed in 59 seconds, while on his last stop, for a new spark plug, only one minute and four seconds was consumed.

Ostewig Makes Good Showing.

The Ostewig, with which Haibe made such a good showing at Indianapolis, went to the pits seven times before its driver decided that he could not keep one of his valve lubricated. About every 10 miles this troublesome valve would lock up.

Twenty-one cars faced the starter and 11 finished. There were several other entries who had qualified, but did not start, as their backers would not let them race on Sunday.

The management of the speedway announced that nearly 100,000 people witnessed the race. An appreciable proportion representing nearly every state in the Union.



Resta in the Peugeot in Which He Covered the 300 Miles at Rate of 98.7 M. P. H.

RESTA LEADS FOR BOSCH TROPHY.

Valuable Cup and Large Sums in Cash Being Competed for by Motor Car Racing Drivers.

Dario Resta, through his victory at Chicago, June 11, becomes the leading contestant in the field of 22 motor car pilots who are risking life and limb to secure the coveted Bosch trophy, which is to be awarded to the champion motor car driver of America during the present year.

The American Automobile Association has arranged a plan by which can be selected the winner of this trophy and some \$13,500 in cash prizes. The victors of all the big and officially sanctioned automobile events that have been run and those scheduled for this summer and fall will be awarded a certain number of points, to be determined in accordance with the mileage of the contest and other factors, and the one having the most points at the end of the racing season will be the winner. The Indianapolis sweepstakes, Sheepshead Bay sweepstakes and the Chicago Derby were included in the championship award events and the next big race to be included in the series will be the contest at Des Moines on June 26th.

In addition to the Bosch trophy the champion for the year will be awarded \$10,000 by the Goodrich Tire Company and \$3500 in cash by the Bosch Magneto Company. It is also expected that before the season is over the cash awards will be much larger, as a number of accessory companies are considering making additional offerings to the winners.

The results of the spring races in this series give Resta an enormous lead over all the other contestants, he having 1800 points against 600 won by Rickenbacher, his closest rival. The standing of the drivers and points to their credit at the end of the Chicago race was as follows:

Driver	Points
Dario Resta	1800
E. V. Rickenbacher.....	600
W. D'Alene	510
Ralph De Palma.....	470
J. Christiaens.....	370
Jules Devigne	320
Ira Vail	300
Ralph Mulford.....	240
C. J. Devlin.....	90
Barney Oldfield.....	80
Eddie O'Donnell.....	80
George Adams.....	55
Galvin	50
Howard Wilcox.....	40
Bert Watson.....	35
Art Johnson.....	30
McCarthy	30
Billy Chandler.....	25
Gable	25
P. Henderson.....	22
O. Haihe.....	20
Lewis	20

RESTA IN OMAHA RACE.

Dario Resta, the winner of the Chicago Derby, has signed up for the 300-mile

dash to be held in Omaha, July 15. Nine drivers have entered the contest to date, including Earl Cooper, who will drive a Stutz; De Palma, Mulford and Vail, with his Hudson. Two Duesenbergs and the Olsen have also been entered.

MODEL INSTRUCTION BOOK.

Without doubt one of the best books of instruction concerning a motor car, as issued by a car manufacturer, is that published by the Locomobile Company of America, which is just off the press. The faults of the average book of the kind, including dullness, poor arrangement and even poorer writing, have been overcome in the Locomobile book.

It is written for all classes of readers,



The Bosch Trophy Offered the Champion Motor Car Driver.

the first part being a purely educational general description of the cars and written for the average reader. This is followed by a semi-technical treatise of each subject or system that will appeal to expert owners, repair men, garage men and dealers. Each system is analyzed in detail, the analyses being supplemented by drawings and photographs which clearly convey the exact meaning of the text.

The last 36 pages of the volume—there are 120 in all—are given over to a wealth of useful information, among which is data concerning speeds, horsepower, anti-freezing mixtures, touring maps in the United States and Canada,

Locomobile, Westinghouse, Eisemann and Willard service stations, state laws and other information of value to owners and service men.

Among the outstanding features of the book are the following: Marginal side heads in red, which makes it easy to find any topic; general description of the whole system at the beginning of each subject; large, clear chassis oiling chart; exceptionally complete index; numerous memorandum pages on which the owner can make notations, and several other distinguishing points that help to make this book distinctive among its kind.

RACE AT PHOENIX, ARIZ.

Steps have been taken to secure the sanction of the A. A. A. for a 250-mile motor race over a three-mile speedway at the Arizona state fair in Phoenix on Nov. 18. The fair commission will offer \$7500 in prizes and it is expected there will be at least 20 entries and 15 starters.

HARTFORD BUMP ABSORBER.

The "Hartford Bump Absorber" is a new "absorber of collisions," being marketed by Edward V. Hartford, Inc., of Jersey City. This accessory, it is claimed, not only prevents the car from being injured by the colliding object, as the bumpers were designed to do, but absorbs the shock so efficiently that the occupants do not feel the shock and jar. It also protects the radiators, lamps and mud guards from injury.

Occupants of a 4000-pound car running at the rate of 15 miles per hour into a pole or tree feel a recoil of but a few inches. The "bump absorber" is made up of a double loop spring on either side and a double leaf spring in the centre, which between them "soak up" almost the entire force of the blow. After compression they spring back into original shape. The absorber can be attached to the car without drilling.

ELECTRICAL EQUIPMENT BOOK.

One of the best books on the subject of starting and lighting equipment for motor vehicles that has appeared in recent months is the volume entitled "Automobile Starting and Lighting," by H. P. Manly, just off the press. It is a non-technical explanation of the construction, upkeep and principles of operation of electrical equipment, containing 302 pages of information concerning 1916 equipment, as well as that of other years which is still in general use. It is designed for the electrical equipment worker, whether expert or novice, and covers in detail all the distinctive parts entering into 24 different makes of equipment now in use. A notable feature is the great amount of data on troubles and remedies.

The book is published by Frederick J. Drake & Co., 1006 Michigan avenue, Chicago, in either leather or cloth covers, the former being priced at \$1.50 and the latter at \$1.

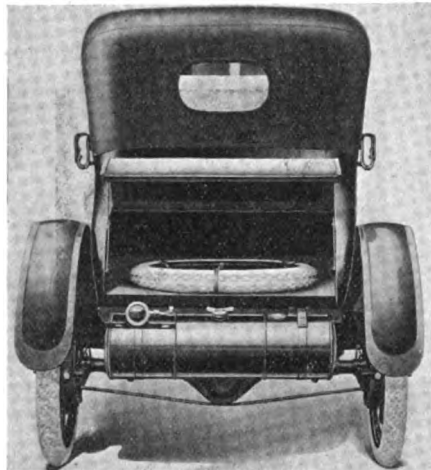


One of the most attractive models ever turned out by the Grant Motor Car Corporation, now of Findlay, O., but soon to be located in a larger plant at Cleveland, O., is the six-cylinder chassis, model K, which has been announced for 1917. The bodies to be mounted on this chassis include a five-passenger touring and a three-passenger roadster type, at \$825, and a cabriolet at \$1050.

All the best features of former Grant models have been retained in the new production, and in addition several refinements have been incorporated. A Wagner two-unit starting and lighting system takes the place of the single unit used last year, and Remy ignition and a Stromberg carburetor with vacuum fuel system and 12-gallon gasoline tank suspended in the rear of the chassis have been adopted. The brakes and the steering wheel are larger, and the front axle is a standard I beam design.

The motor remains unchanged in essentials. It is a three by $4\frac{1}{4}$ overhead valve, block cast six-cylinder engine, which is rated by S. A. E. standards at 21.6, but is said to develop a much greater horsepower in actual service. The upper half of the crank case and the main cylinder casting form a compact unit, the crankshaft being carried in constant alignment with the cylinders. The valves and their working parts are carried by the head casting, which is bolted to the cylinder block, and it is comparatively easy to get at pistons and cylinder walls when necessary.

The crankshaft, made of special alloy steel, is a drop forging and $1\frac{9}{16}$ inches in diameter. The three large bearings employed measure in length, from front



View of Rear of Roadster, Showing Large Compartment for Spare Tires, Suit Case or Extra Baggage.

to rear respectively, 2 $19/32$, two and three inches. The cast iron pistons each carry three rings and are designed for lightness. The camshaft is provided with three bearings, and the cams are formed to insure maximum quietness of operation.

The Stromberg carburetor is connected directly to the cylinder casting, the distribution of fuel being done within

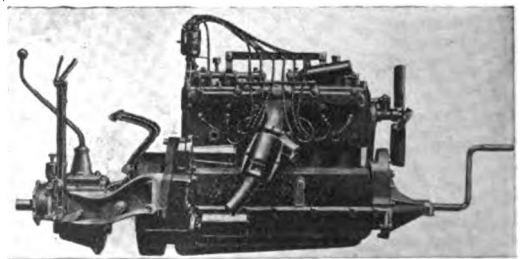
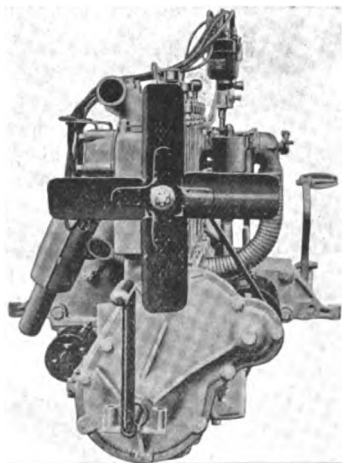
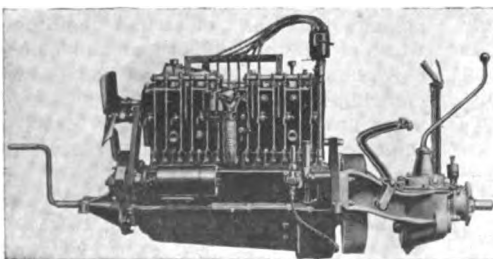
the casting itself. The double branch external manifold joining the carburetor with the two gas inlets in the head unit as used last year has been eliminated.

Remy ignition has been adapted for this model, though the location of the distributor and the method of drive remain as in last year's models. The distributor is located high on the left hand side at the rear and is arranged to provide plenty of room to run the wires without interfering with the plugs. A bracket at the top of the casting supports the wires and carries each ignition lead clear of the valve parts.

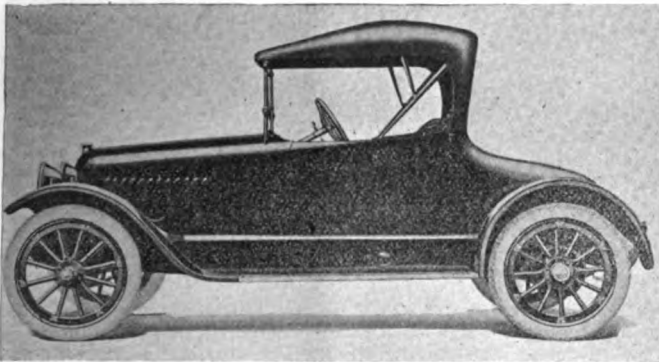
The starting and lighting system is a Wagner two-unit type, the starting motor being mounted at the rear on the right hand side of the motor and driven through the Bendix centrifugal action system to teeth cut in the rim of the flywheel. The generator, which is carried forward on the left hand side, is driven by an extension of the fan driving shaft, a leather universal coupling being provided to compensate for variation in alignment and to make a noiseless connection.

Lubrication is by a circulating plunger pump positively driven off the camshaft and delivering the oil through a dash sight feed and to the front gear case and to the rear of the engine from which it overflows into the successive connecting rod troughs and back into the reservoir in the motor case. In unit with the oil pump case is an oil level indicator.

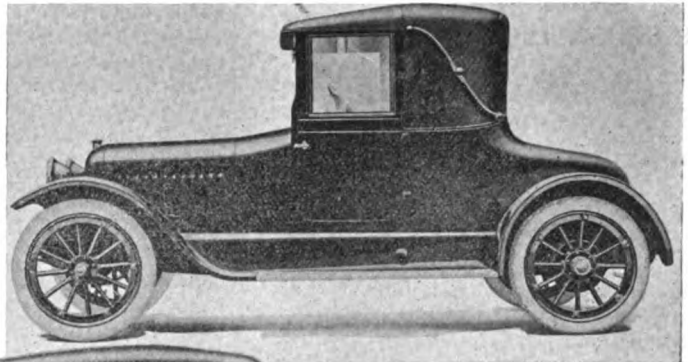
Cooling is by the thermo-syphon system, which is aided by a four-bladed pressed steel fan that is driven by a belt. The fan mounting has the conventional provision for taking up slack that may



Three Views of the Grant Six Power Plant, Which Has Been Carried Over from 1916 Into the New 1917 Models.



The Grant Roadster,
Priced at \$825.



The Grant Cabriolet, Three Pas-
sengers, Priced at \$1050.

develop in the belt. The radiator is the usual rounded front type and of a special tubular design.

The transmission is of the selective sliding gear type having three speeds forward and a reverse. The 12-inch leather faced, pressed steel cone clutch uses a ball thrust and is noiseless in operation.

Easy gear changing is insured by the employment of a small clutch brake.

The rear axle is of the full floating type. It is of special Grant design with three-point suspension, which in connection with the three-point suspension of the motor, positively eliminates distortion and maintains the alignment of the driving parts. Adjustments are easily made after removal of an inspection plate at the rear.

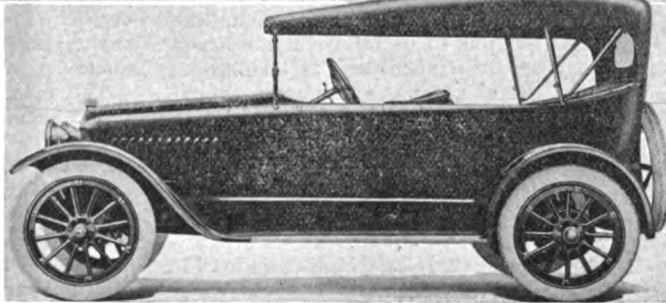
The brakes are double and are internal expanding and external contracting, asbestos lined. The drums have broad faces and are 12 inches in diameter.

The steering gear is of the irreversible, worm and sector type, and safe and easy operation is insured by the 18-inch diameter steering wheel. Centre control, left hand drive, throttle lever under the wheel and foot accelerator is standard practise. There is unusually wide room below the steering wheel and generous leg room in both front and rear compartments.

Semi-elliptical springs, 34 inches in length, are used at the front, and true cantilever, 38 inches long and two inches wide, at the rear. Because of the three-point suspension of the rear axle the springs are entirely relieved from all driving strains, resulting in perfect spring action at all times. The rear sets are carried under the frame, thus relieving the latter from all twisting stresses. When the five-passenger model is fully loaded the rear springs are practically horizontal with the road, this, so it is said, being an ideal condition for perfect spring action. The machine is of the standard 56-inch tread and the wheel-base is the same as last year, 112 inches.

Artillery type wheels fitted with Firestone demountable rims are standard equipment. Straight side 32x3¼-inch tires are fitted all around with non-skids on the rear.

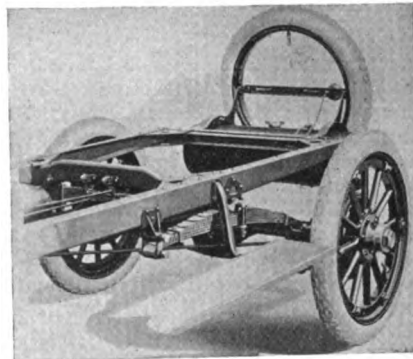
Other parts of the regular equipment



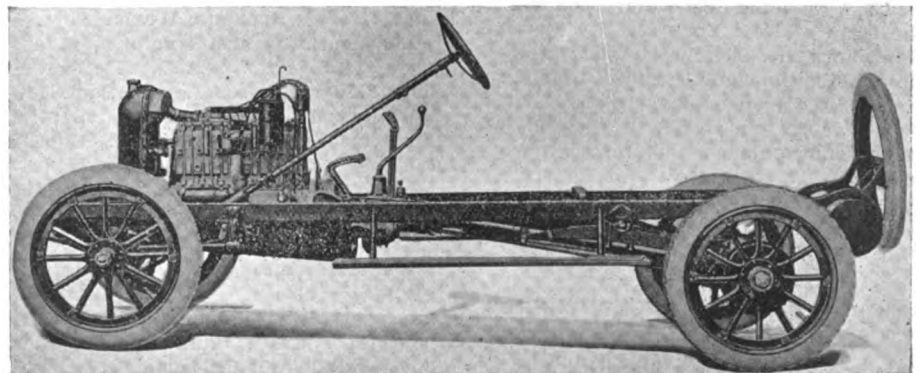
This Five-Passenger Touring Model, and the Two Types Shown
Above Are Mounted on the Same Chassis, Model K.

include a one-man top with mohair top slip and inside curtains, electric horn, double bulb electric headlights, electric tail and dash lights, speedometer, sight oil feed on cowl dash board, ammeter, spare tire carrier at rear, license bracket, plate glass, two-piece, rain vision windshield, which is adjustable to any position, and a complete tool kit.

In the roadster and cabriolet models the spare tire is carried in the rear compartment, leaving the body lines clean.



Rear of the Chassis, Showing True
Cantilever Spring Suspension,
Strong Frame Braces and Fuel Tank.



View of the Stripped Chassis of the New Grant Six for the 1917 Season.

The seats are made comfortable by deep, wide, tilted cushions, which have long springs and padded with curled hair.

Owners of the 1916 Grant Sixes report an average of 20 miles to the gallon of gasoline and 900 miles to each gallon of lubricant. The maker declares that the new 1917 Grant Six is equally economical in operation.

That Grant cars have been favorably considered by car buyers is indicated by the fact that during the past two years the company's production has increased from 2000 to 20,000 cars annually. This year the Grant corporation is enjoying unparalleled prosperity and with a capital of \$4,000,000 it is generally predicted that even more rapid expansion will take place in 1917.

CHALMERS MAKES NEW RECORD.

Driving a Chalmers Six-30 roadster 3400 revolutions per minute, B. F. Durham of Detroit recently broke all records for time between Chicago and New York, making the distance of 1047 miles in 31 hours flat, and driving half of the journey in a downpour of rain. The old record was made by E. C. Patterson, a New York publisher, he making the trip last July 15 in 35 hours and 43 minutes.

The Chalmers car, a stock model, carried full equipment and made an average speed of 33.7 miles per hour. The motor operated almost continuously, the only stops being for gasoline, oil and water, and the car was sent over every high grade in high gear.

Durham was relieved by A. E. Walden in the drive from Cleveland to Elmira.

Scottish Lord Makes Record Run.

Driving a Chalmers Six-30 Nobleman
Made 358 Miles Through New
York's Busiest Streets.

Lord Douglas Gray, a Scottish nobleman and British army aviator, recently drove a Chalmers Six-30 touring car a distance of 358.7 miles in 24 hours through the busiest streets of New York City. Lord Gray made a record in London three years ago in a Vauxhall car, driving 251 miles. The route extended the length of Manhattan, from Abbey hill to the Battery and by way of Broadway and Fifth avenue, two of the most densely crowded avenues in the city. The driver made the circuit 14 times, and during the run was forced to make 147 full stops. His lowest mileage was nine miles an hour, in the third hour of the run, in which he made 18 stops. His highest mileage (17.3 miles) was scored in the 19th hour, in which no stops were made. The greatest number of stops was made in the fifth hour, there being 29 in all. The car was a stock machine, owned by the nobleman's father-in-law, Willard Wilson of New York City.

KNIGHT SLEEVE-VALVE MOTORS.

A most instructive book on the subject of the advantages of the Knight sleeve-valve motor is being distributed among engineering classes of the colleges of this country by the Willys-Overland Company, Toledo, maker of Willys-Knight motor cars. This is a very valuable and interesting treatise, showing as it does the history of that motor type, the reason for the design, the operations of the various components, the economies obtained and the advantages it possesses in several features over types of poppet valve motors. The illustrations form a very valuable part of the book, they tending to delineate very clearly the points brought out in the text. Inquiries concerning the book should be addressed to the Willys-Overland Company.

RECIPROCITY WITH ONTARIO.

Arrangements have been made whereby Ontario motor licenses are honored in the state of New York for 21 days and New York licenses in the province of Ontario for the same length of time. Previously it was necessary to take out a license for a trip across the border and much inconvenience and many arrests resulted. To celebrate the new arrangement a large party of Canadian motorists made a tour into New York state June 9 and 10.

HOLDS DRIVERS RESPONSIBLE.

Police Commissioner John Gillespie of Detroit, who has done much original work in perfecting the system of safety

THE AUTOMOBILE JOURNAL.

zones and traffic aisles, as well as the production of the "Stop" and "Go" semaphores, has announced that so many accidents in traffic have been caused by careless drivers that hereafter the police will assume that the motorist is invariably to blame for such accidents until it has been proved otherwise and will be arrested or summoned at once.

The Department of the Interior, which controls the roads of Yosemite valley, has issued new rules to govern motorists during the coming summer. They concern the entrances to the park, the roads open to traffic and the conditions and directions to be followed, the speed, the stops, the penalties for violations and a list of garages and camps. Penalties and accidents are covered, as well as the hours for safe driving.

COMING EVENTS IN MOTORDOM.

June.

Race (speedway), Des Moines June 26-28
July.

Convention, World's Salesmanship
Congress, Detroit July 2-6
Race (speedway), Minneapolis... July 4
Race (speedway), Sioux City, Ia. July 4
Race (speedway), Tacoma..... July 4
Race (speedway), Coeur D'Alene July 4
Race (road), Visalia, Cal..... July 4
Race (track), Elmira, N. Y..... July 4
Race (track), North Yakima, Wash.
..... July 15

Race (track), Omaha, Neb..... July 15
Demonstration (farm tractors), Dallas,
Tex..... July 17-21
Demonstration (farm tractors), Hutchinson,
Kan..... July 24-28
Demonstration (farm tractors), St.
Louis, Mo..... July 31-Aug. 4

August.

Race (track), Tacoma, Wash..... Aug. 5
Demonstration (farm tractors), Fremont,
Neb..... Aug. 7-11
Race (track), Kalamazoo..... Aug. 11-12
Hill Climb, Pikes Peak..... Aug. 11-12
Race (track), Portland, Ore..... Aug. 12
Demonstration (farm tractors), Cedar
Rapids, Ia..... Aug. 14-18
Race (road), Elgin, Ill..... Aug. 18-19
Demonstration (farm tractors), Bloomington,
Ill..... Aug. 21-25
Race (track), Kalamazoo..... Aug. 26

September.

Show, Columbus, O..... Sept. 2-9
Race (track), Elmira, N. Y..... Sept. 4
Race (speedway), Des Moines... Sept. 4
Race (speedway), Indianapolis... Sept. 4
Race (track), Spokane, Wash... Sept. 4-5
Demonstration (farm tractors), Madison,
Wis..... Sept. 4-8
Show, Milwaukee..... Sept. 11-16
Race (speedway), Providence... Sept. 16
Race (track), Trenton, N. J..... Sept. 29
Race (speedway), New York, Sheepshead Bay
Speedway..... Sept. 30

October.

Convention, National Association Automobile
Accessory Jobbers, St. Louis..... Oct. 2-5
Race (speedway), Omaha, Neb... Oct. 7
Race (speedway), Philadelphia... Oct. 7
Race (speedway), Chicago..... Oct. 14
Race (speedway), Indianapolis... Oct. 19
Race (track), Kalamazoo, Mich. Oct. 21

Ultimate Fate of Racing Cars.

Majority Are Diverted to Every Day
Uses, but Some Are Kept
for Exhibition.

Many motorists often inquire as to the end of the famous racing cars. Such an inquiry was addressed to the Nordyke & Marmon Company of Indianapolis concerning its old Marmon cars, which became famous in the early days of motor car racing for their consistent performances on speedway and dirt tracks.

The most famous ever turned out by the Marmon company is the Marmon "Wasp," a six-cylinder car, which won the first 500-mile International Sweepstakes, May 20, 1911, at Indianapolis, beside several events of lesser fame. After the 1911 race the car was retired and since then has been used mainly for exhibition purposes.

In 1909-10 the Marmon company produced the two small four-cylinder cars which became known as the "Yellow Jackets," and won races at Long Island and at Atlanta, Savannah, Santa Monica, Elgin and Indianapolis. In addition to these the company built two larger cars and they won races in various parts of the country. The "Yellow Jackets" were sold in 1912 when the Marmon company withdrew from racing, and are now being used, not for racing purposes, but for every day uses. The larger cars were eagerly sought by racing enthusiasts and today are competing on race tracks in the hands of private individuals.

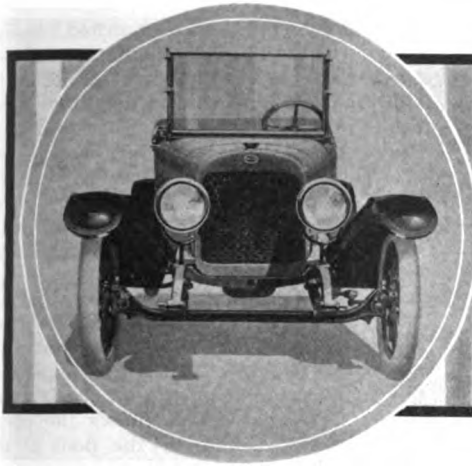
It would seem that racing cars are returned to general service in the majority of cases, though some of the companies keep one at least for exhibition purposes.

AUTOMOBILE STATISTICS.

A recent issue of statistics concerning the number of automobiles registered in Canadian cities in 1915 show the following:

City	1914	1915
Vancouver	2578	3719
Victoria	1760	2363
Winnipeg	3304	3688
Hamilton	1151	1546
Ottawa	985	1109
Toronto	7367	8815
Montreal	3869	3917
Regina	878	1123

The government of British Columbia has spent large sums in recent years in building and maintaining roads in the province, which now has an excellent system of highways. Good roads, an equable climate and beautiful scenery conspire to encourage motoring in the north Pacific coast country to such an extent that British Columbia now has a greater number of automobiles in proportion to the population than any other province in the Dominion.



Complete Details of New Regal Model

Regarding its new 4 thirty-two model, a brief description of which was published in the June 10 issue of this magazine, the Regal Motor Car Company, Detroit, declares that it is "a worthy associate of the more expensive cars" and that this model is representative of all the best results obtained by eight years of automobile practise by the Regal company. Experience has dictated the elements of sturdiness and dependability built into the car.

The new Regal model as a pleasure vehicle will appeal to women especially, because of its ease of operation and because of its stylish appearance. It is a vehicle which reflects good taste, nicety of detail and the permanent style so much desired in automobiles.

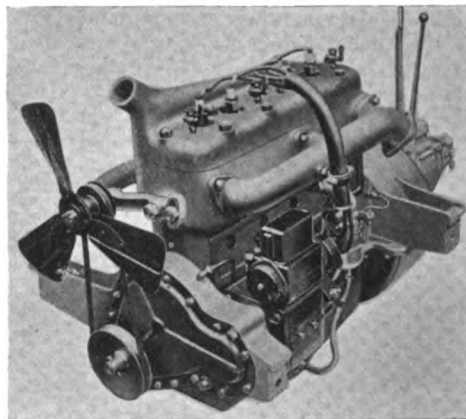
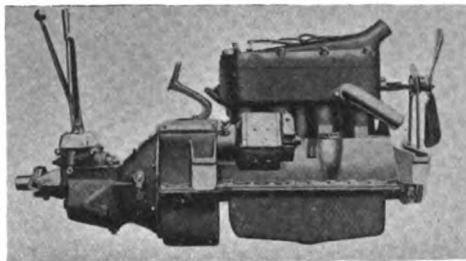
As regards power, the maker claims 32 horsepower and the ability to throttle down to four miles per hour in high, which can be increased to 40 miles in 40 seconds and to 47 miles in 45 seconds. The machine is built to travel better than 20 miles on a gallon of fuel and 300 miles on a quart of oil, which indicates its economy of operation.

The four-cylinder motor, which is built by the Regal company in its own plant, is patterned after the larger Regal standard four engine that has been proving satisfactory for several years. In the new power plant, which is suspended at four points, several refinements have been incorporated. The cylinders, the bore of which is $3\frac{1}{2}$ and the stroke $4\frac{1}{4}$ inches, are cast en bloc and are integral with the upper half of the crank case. The block is of the L head design and has a removable head, making for ready access to the piston heads and valves.

All valves are fully enclosed and are interchangeable. They have carbon steel stems and cast iron heads of 1 $\frac{25}{32}$ inches diameter with a clear opening of 1 $\frac{9}{16}$ inches. The round nose, non-whirling valve lifters are easily adjusted.

The high carbon steel drop forged, heat treated crank shaft is offset $\frac{3}{8}$ of an inch. There are three die cast bearings lined with nickel babbitt, the forward bearing being 2 $\frac{5}{8}$ inches long, the centre 2 $\frac{1}{4}$ inches and the rear 3 $\frac{1}{4}$ inches. The flywheel is bolted to a large diameter flange.

Pressed steel is used to form the lower half of the crank case, which is carefully designed and thoroughly ribbed for strength and rigidity. The shaft bearings are of the split type, adjustable and



Two Views of the Power Plant of the New Regal 4 Thirty-Two Model.

carried in the upper part of the case. The timing gears are enclosed in a separate case, with pressed steel cover.

Lubrication is by the constant level circulating splash system, with plunger pump operated by cam shaft. The system has capacity for four quarts of oil. On one side of the crank case is a large mouthed filler opening and float indicator gauge.

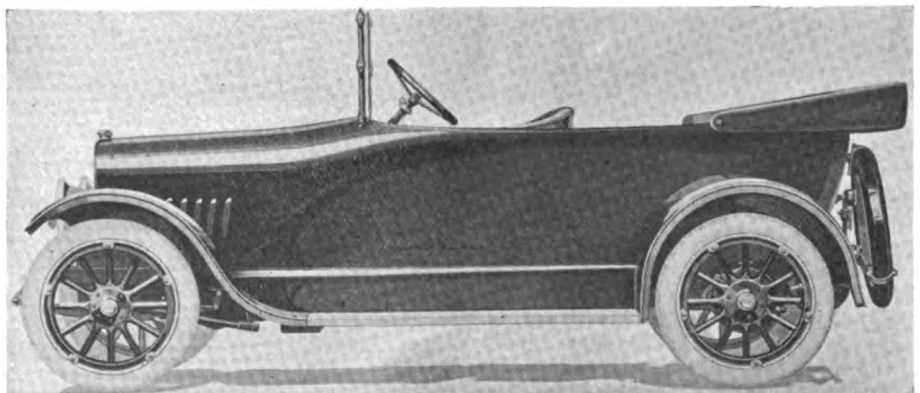
The carburetor is of the float feed variety, hot water jacketed, and is mounted close to the cylinders on the left hand side. The main supply of gasoline is carried in a 14-gallon tank secured to the rear of the chassis and is fed to the carburetor by the vacuum system.

Cooling is effected by the thermosyphon system. Large area pipes and large free water spaces, which entirely surround the cylinders and valve ports, insure the efficiency of the system. A three-blade propellor fan of 16 inches diameter amply assists in the cooling operation. The McCord radiator is of the improved cellular design, with detachable core.

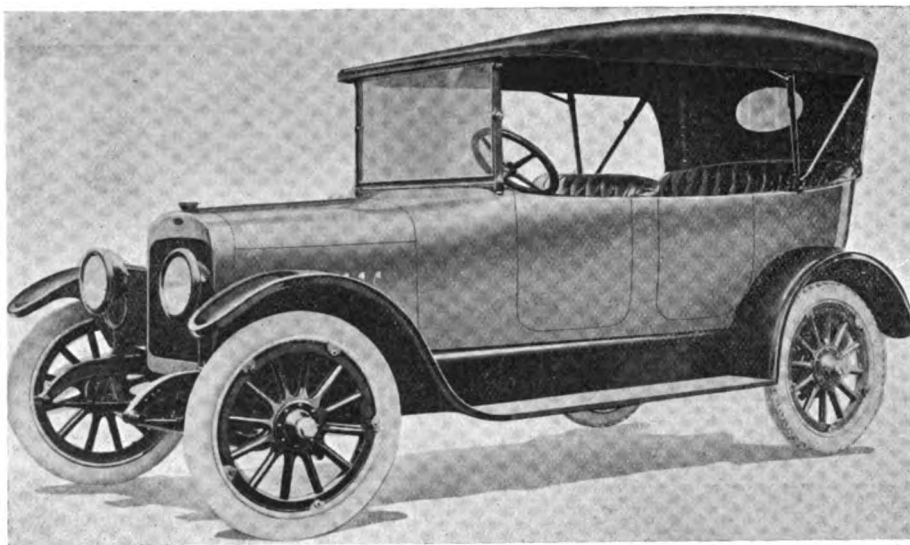
The clutch is a leather faced cone of light pressed steel and gradual engagement is insured by small spring inserts under the leather facing. The construction also incorporates an improved silent ball bearing throw-out device.

The transmission is in unit with the motor. It is of the selective sliding gear type with three speeds forward and reverse. All gears and shafts are made of nickel steel alloy and heat treated, the main shaft operating on ball bearings, while the jackshaft runs on bearings of the plain type. The propellor shaft is fully enclosed and all torsion is taken by the tube and yoke.

The electrical equipment consists of a Heinze-Springfield two-unit starting, lighting and ignition system. Direct gear from the camshaft is used for driving the generator. The ignition unit is mounted on the rear housing of the generator. The breaker and distributor are of magneto type and being located with the coil and regulating switch integral with the



The Regal 4 Thirty-Two, the New Model Which Has 108-Inch Wheelbase and Sells for \$605 Completely Equipped.



The New Regal Four, Which Is Distinctive in Appearance and Is Declared to Be Very Economical in Operation.

generator greatly simplify the wiring system. Light and well designed breaker parts make it possible to time accurately the spark at all engine speeds. The coil is well balanced, thereby eliminating all sluggishness from the ignition system. The starting motor is connected to the engine by means of a Bendix drive. The storage battery is of the six-volt, 80-ampere design, and is equipped with standard terminals.

The front axle is an I beam drop forging with the tie rod located at the rear. Elliott type, wide yoke, steering knuckles are used and the wheels are carried on adjustable ball bearings.

The rear axle is of the three-quarter floating type and, with the differential, is carried on Hyatt high duty bearings. The propellor shaft is mounted on two ball bearings and the pinion thrust is taken by New Departure double row ball bearings. The final drive is by spiral bevel gears which have gear ratio of 4.25 to 1.

The brakes are external contracting and internal expanding and are faced with asbestos composition lining. The drums are 10 inches in diameter and have 1½-inch face, and the brakes are equally effective with the car moving in either direction. Artillery type wheels made of second growth hickory are standard equipment on this car. All wheels have 12 spokes and demountable rims carrying 30x3½-inch tires. Non-skid oversize tires will be fitted to the rear wheels if desired.

The rear springs are of the cantilever design, 40 inches long and two inches wide, and are mounted under the frame, relieving all side strain. Semi-elliptical springs, 34 inches long and 1½ inches wide, are used at the front. They are made of a special analysis spring steel and heat treated. Ample lubrication to the suspension points is provided by grease cups.

The frame is composed of hot riveted pressed steel and is of tapered construction, being wide at the rear, with springs shackled directly beneath, and narrow at the front to permit short turning. The metal is 5/32 inch thick and the depth of the section is 3½ inches.

The steering gear is of the irreversible, worm and gear type, and is adjustable for wear. Steering is greatly facilitated by the installation of a 16-inch wheel.

The car has a wheelbase of 108 inches and a road clearance of 10½ inches.

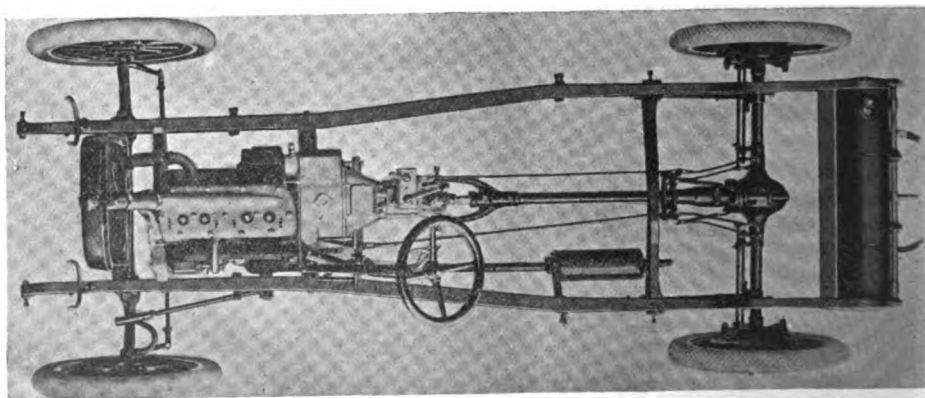
The body, which is extra roomy, has seating capacity for five passengers. It is of the full stream line type and is finished in Regal blue. The rear seat is 46 inches wide and 14½ inches high from the floor, while the front seat is 42



The Improved Spring Assembly of the New Regal Car.

inches wide and 12¼ inches high. The upholstery is covered with straight grained semi-gloss Fabrikoid. The running boards are covered with cork linoleum. The front compartment can be entered from either side and very easily.

The wheels are regularly finished in Regal blue, the hood, fenders and radiator in black enamel and the chassis in black. Other features of the standard



The Chassis Is a Clean Cut "Job" and Is Built for Sturdiness as Well as Flexibility of Power and Long Service.

equipment include full crowned, heavy gauge pressed steel fenders, electric headlights with dimmer attachment, electric dash lamp and tail light, electric horn, one-man mohair top with slip cover, quick adjustable inside curtains, Stewart speedometer, ammeter on cowl board, rain vision ventilating windshield, extra demountable rim, tire holder at rear, complete set of tools, jack, tire repair outfit and pump.

Every minor detail of new Regal model has been given consideration so as to afford the greatest amount of comfort possible. An example of this care is shown by the arrangement of the accelerator, the operation of which allows the operator's foot to be flat on the floor at all times.

The price of this model is \$695 completely equipped as specified.

NEW HOUR MARK.

Ralph De Palma during the qualifying trials for the annual derby at Chicago, made a new American record for distance covered in one hour's time, covering 93.72 miles in the 60 minutes.

It was an event of great interest in motor racing circles, as this was the first hour trial made in this country since banked speedways came into general use. For years one-hour speed trials at the Brooklands track in England have stirred up the keenest rivalry.

During the first 30 laps of the Maywood track De Palma's speed average was 92.25. At 35 laps his average was 91 and at 40 laps it was 93 miles.

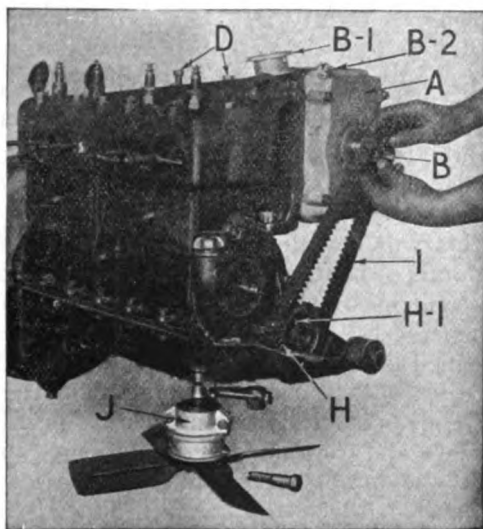
ALL-YEAR MODELS.

H. S. Daniels of the Kissel Motor Car Company says that aside from the unprecedented demand for cars, the most significant feature of the situation this season has been the large percentage of buyers who want the All-Year model. "Owners seem to be realizing," he says, "that they are depriving themselves of half the utility and pleasure of motoring by putting their cars away when the first snow flies. Despite the fact that the KisselKar factory facilities have been doubled this year and production is going on as per schedule, dealers are having trouble getting a sufficient supply of cars."

MOTOR STARTING AND CAR LIGHTING.

Installation of the Westinghouse Starter-Lighter Equipment in the Ford Chassis, Described and Illustrated--The Manner of Adjusting the Electric Unit.

WHEN using the expanding or "bulldozing" tool there is probability that the metal of the crank case extension, which is strengthened



The Manner of Placing the Sprocket on the Shaft of the Electric Unit.

by the forward end bearing riveted to it, will not yield easily when tool is revolved upon the crankshaft end or spigot. The tool made specially for the work by the Westinghouse company is in two sections, so that it may be reversed, and used for either right or left hand operation. To obtain efficient operation of the sprocket there should be at least $\frac{3}{8}$ -inch clearance between it and the crank case, and the expansion, if well done, should spread the metal so that there is a groove or channel in it about the sprocket. With a hammer the crank case can be shaped, using the tool practically as an anvil, and this can be done very accurately if pressure is applied to the tool while the metal is struck with the hammer. Care should be taken to place the spacing hub, shown at X-I, in the second and third illustration, against the engine case while the "bulldozing" tool is used. The expansion of the case is not difficult, but considerable care is necessary to do it evenly and well.

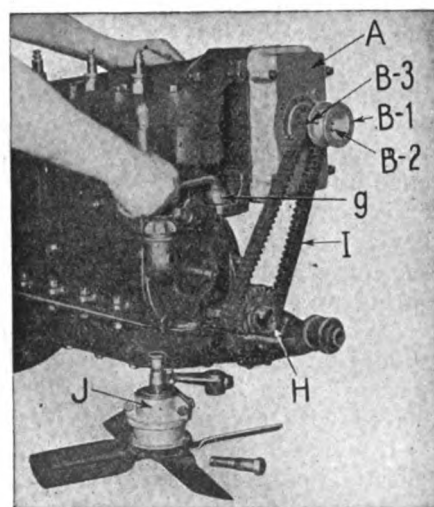
When the expansion has been made the crankshaft sprocket is to be installed. The sprocket is assembled at the Westinghouse works and has been adjusted to obtain the tension that will insure efficient operation. In installing it the sprocket is dismantled. The makeup of the assembly is shown in one of the illustrations describing this installation. Preliminary to placing the sprocket one should see that the pin hole in the crankshaft end is in the vertical position

shown in the first illustration of the previous article. The sprocket may then be forced on to the crankshaft, as is shown in the fourth illustration, by hammering it. The hole in the sprocket should be in exact line with the hole in the crankshaft. Because of the stresses of driving upon the sprocket it must be a tight fit on the shaft, and it should be driven on with a copper or brass bar. The correct use of the copper or brass bar is shown at b in the fourth illustration.

Sprocket Must Be Precisely Placed.

When the sprocket is on the shaft and the hole in both are in exact line, the pin, shown as H-1 in the illustrations, should be driven through the sprocket hub and the shaft. The headed end of the pin should be flush with the surface of the sprocket hub, and if the pin H-1 does not tightly fit the hole in the shaft it should be bent slightly in the centre so that it will bear in the centre and at both ends, against the shaft and the hub. A drift, which is designated as f in the fifth illustration, should be used for driving the pin into the holes, so as not to damage the hub or the pin. One should be sure that the pin does not project too far at the lower or extended end as to prevent the turning of the sprocket on the hub. The length can be determined by placing the sprocket, designed as H-4, on the hub and turning it several revolutions. If it cannot be turned freely the pin H-1 probably strikes the inside of the sprocket. By cutting the ends the pin can be shortened so that the sprocket can be turned freely. This is merely a process of testing until sufficient clearance is obtained.

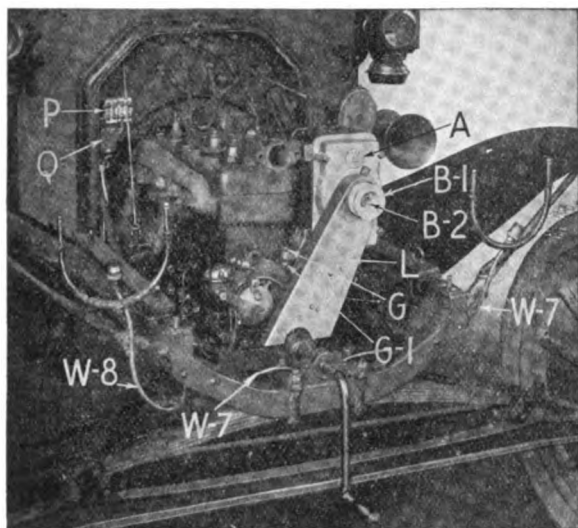
When the pin has been carefully fitted the sprocket should be removed from the hub; then place one of the



Tightening the Mounting Bracket After the Shaft Sprocket Has Been Fitted.

friction collars designated as H-5 on the hub. Next spring the spring ring H-2 into place on the hub so that the slot in the ring engages with the projecting end of the

pin through the sprocket hub and crankshaft. The open end of slot should be toward the front end of the crankshaft—in fact it cannot be in-



The Unit with the Chain Guard Fitted—The Lighting Switch, Fuse and Headlight Wiring.

stalled in any other way. (One should note fully the details of the sprocket assembly shown in the illustration of that member.) Be sure that the free end of the spring ring projects at least $5/16$ inch out from the surface of the sprocket hub. This length should be known from precise measurement.

Chain Must Run in One Direction.

Now the silent chain I should be placed under the sprocket in such position that it will run or turn in the direction shown by the series of arrows stamped on the edge of the chain. The sprocket H-4 should be slid over the spring ring. Next, the sprocket should be packed with cup grease and then the other friction washer, shown as H-5, should be placed on the forward side of the sprocket. Then the stationary washer H-6 is placed over the keyway in the sprocket hub, and the spring washer H-7 is put on outside of this and is secured by the nut H-8, plainly shown in the illustrations. The nut H-8 should be tightened until the mark "O" on the nut corresponds or is centred with reference to the mark in the keyway on the hub. The grooves in the face of the nut should "register" with the flutes of the spring washer.

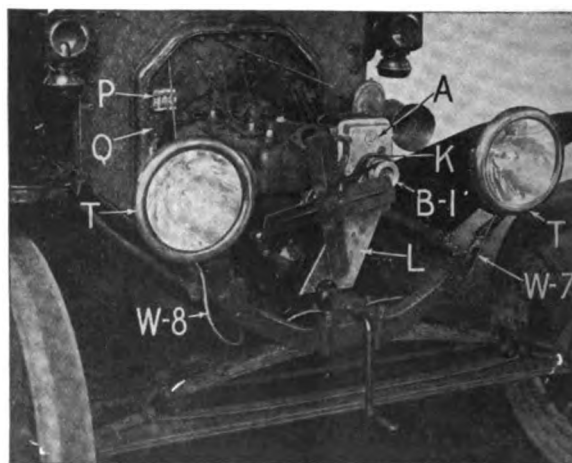
When this work has been completed the nut should be taken from the left bolt retaining the forward main bearing, and this should be replaced with the special flat Westinghouse nut G-1, which is seen in the first illustration of the Westinghouse series. Then the Ford timer can be replaced. The Westinghouse electric unit A is placed on the engine, the lower or base bracket being fitted over the end of the forward main bearing retaining bolt, and the upper side flange or bracket projecting over the cylinder head. The special conical nut indicated as G in the illustra-

tion is used on the end of the main bearing retaining bolt, and three special screws, designated as D, retain the upper side flange, these taking the place of the regular Ford cap screws. After the unit has been placed and the nut and screws set so it is not movable, the distance between the centres of the crankshaft and the shaft of the electric unit should be checked. This distance should be $11 \frac{25}{32}$ inches, and it can be determined as shown in the seventh illustration. The reason the nut and screws should be set, not necessarily as tightly as when permanently adjusted, is that all four points of support must contact firmly. This is imperative.

Precise Distance Between Shaft Centres.

Should the distance between the centres be more than $11 \frac{25}{32}$ inches, which may be found when fitting the unit to engines built later than 1913, this will be caused by one or more of the three points of contact on top of the engine being high. Which points are high should be marked and then the bosses of the flange of the electric unit, which is indicated as C, should be filed until the unit contacts at all four points and the centre distance is correct. When this has been done the screws and the nuts can be tightened firmly.

Next the sprocket B should be removed from the shaft of the electric unit, and after the sprocket has been placed in the silent chain I, as the sprocket should be pressed on to the shaft, as are shown in the first illustration of this installment. When the sprocket is on the shaft there should be at least 10 pounds of tension on the chain. In the event that there is less than the degree of tension specified, shims should be placed under the points of contact, as is shown in the diagram of the front and side of the unit and engine as F and F-1, until the tension required is obtained. The tension on the chain should not exceed 10 pounds, however.



The Fan Installed on the Engine and the Headlights Mounted.

After the fan pulley B-1 has been replaced on the shaft of the electric unit the nut B-2 should be tightened and secured by the cotter pin B-3.

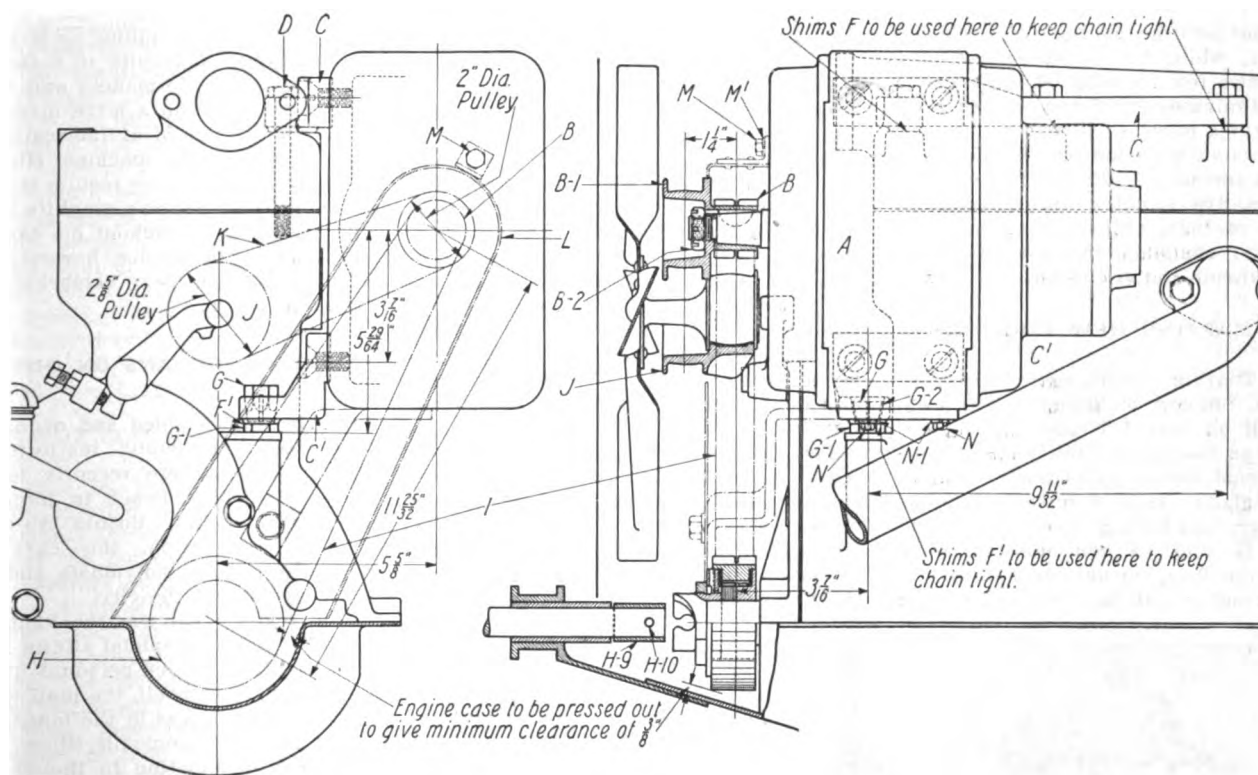
which are all shown in the second illustration in this article. The chain guard L is mounted on the electric unit and it should be lined as is shown in the third illustration. The split fan pulley J should be clamped on the Ford fan pulley, as is shown in the first and second illustrations, and the fan should be replaced on the engine, using the new fan belt K, that is also shown. If necessary, bend the fan blades slightly to clear the pulley on the electric unit. Instead of the Ford cranking claw and pin, use the Westinghouse sleeve H-9 and pin H-10. If the Ford starting crank is found out of alignment when replaced, a bar may be inserted in the starting crank bearing and the bearing sprung into alignment. This practically completes the installation of the unit.

When this is done the Westinghouse two-

apron to match the holes in the box. When the battery has been placed in the box it should be secured by the hold-down bolts.

Wiring Depends on Lamps Used.

The wiring of the chassis is dependent upon whether or not the original Ford lamps, with dimmer, or Westinghouse lamps, with two bulbs each, are to be used. The wiring diagram that will serve for either make of lamps is provided. If the Westinghouse lamps are to be installed the dimmer is removed and except where wood screws may be used to attach holding cleats to wood parts, all the cleats should be fastened under bolts already on the chassis. Care must be taken that all the cable terminals do not touch any parts of the chassis other than the studs to which they should be attached.



Front and Side Elevations of a Ford Engine Showing the Correct Location and the Means of Adjusting the Electric Unit and the Auxiliaries of the Westinghouse Starter-Lighter.

gang lighting switch P should be mounted on the front of the dash, as is shown in the third illustration of this article, cutting a rectangular hole in the dash at a point low enough so that the carburetor adjusting rod will not touch the contact screws of the switch when it is secured by four wood screws through the cover plate on the face of the dash. Mount the fuse Q, shown in the same illustration, just below the lamp switch on the engine side of the dash as is shown. Slight change of the speedometer may be necessary with cars with cowl dashes. The starting switch and generator cut-out O should be located on the footboard at the left side of the chassis, about two inches from the frame. The battery box is mounted on the right running board, and this can be done by drilling two 3/4 inch holes in the

The operation of the electric unit depends to a considerable extent upon the adjustment of the silent chain. For this reason there is tension on it when first adjusted, but after it has been driven approximately 2000 miles the chain will slacken so that it will strike the chain guard. To make adjustment the radiator and water connections should be removed and the conical nut on the lower supporting bracket loosened and the three upper screws taken out. Shims must be placed under the bosses of the upper supporting flange and the lower bracket until the right height is obtained. This can be best done by putting shims under the forward point only until the chain is tight, and then placing the same number under each of the other points.

(To Be Continued.)

RESTA VICTOR IN AUTO MATCH.

In Challenge Race DePalma Is Defeated In All Three Heats of the Contest at the Chicago Speedway.

Dario Resta, who snatched the victory from De Palma at the Chicago Derby on June 11, won all three events in a match race with his opponent over the same course on June 18.

The heats were 50 miles, 24 miles and 10 miles. Resta's time for the first race was 31 minutes, 57 2/5 seconds, an average speed of 96 miles an hour, while De Palma's time was 32 minutes, 18 seconds, an average speed of 93 miles. In this event De Palma's engine developed trouble four miles from the finish and he crossed the line with only two cylinders working.

Resta made the 24 miles in 13 minutes 42 3/5 seconds, an average of 109 miles an hour, while De Palma crossed the finish but a few seconds behind, his time being 13 minutes 45 4/5 seconds, an average of 104 1/2 miles an hour.

De Palma's time for the 10-mile event was not announced. Resta made the distance in five minutes 5 1/2 seconds, an average of 102 1/2 miles an hour.

A silver challenge cup was presented to the winner at the close of the race.

TIB MAPPING NEW ENGLAND.

The Touring Information Bureau of America, Shukert building, Kansas City, Mo., will on July 1 begin mapping the motor car routes in the northern Atlantic Coast states, particularly those of New England. It is planned to have at least four "pathfinding" cars on the road constantly and to continue the work "until snow flies," or until it is done.

The results will be published in the

Tib automobile route books and because of the manner in which these volumes are arranged will constitute most comprehensive and serviceable tour books of the New England states.

Tib touring books contain detail maps and running directions for all the main routes between important points and enable the motorist to reach practically every town in the various states. In addition they present information concerning the garages and hotels to be encountered. The bureau also maintains a special information service which is at the disposal of inquirers.

SCRIPPS-BOOTH'S ABROAD.

Prince Andre of the royal house of Greece, is the latest member of the foreign nobility to purchase a Scripps-Booth car. These popular little cars have won favor with the members of royal families, who like the pleasure of driving their own machines, and it is claimed that there is at least one Scripps-Booth in almost every royal garage.

The car was sold through the Scripps-Booth agency at Athens and as a result of this royal patronage the dealer has been presented with a diploma giving him the title of "Furnisher to the Royal House of Greece."

The Scripps-Booth is also attracting a large following among the wealthier class of people in Cuba. Additional interest was attached to this car on the island as a result of its phenomenal performance in a recent race, finishing third in a field of high powered Ameri-

can and foreign cars. The race was won by a Chenard-Walcker with a motor of 169.65 cubic inches displacement and a Mercedes with 159.5 cubic inches displacement came in second. The Scripps-Booth has a motor displacement of only 103.87 cubic inches.

LUBRICANTS USED BY RACERS.

When an automobile or any other mechanical device devours space at the rate of 100 miles an hour or more, such as is a commonplace incident with Dario Resta in his Peugeot, there are two vital principles involved. One is a good lubricating system and the other is good lubricants. This is particularly true when this high velocity is maintained through long periods. For this reason much interest is attached to the brand and kind of lubrication used by the foremost speedway drivers whose machines must be as near infallible as it is possible for human ingenuity to make them. Dario Resta's performances and wonderful successes are in a large measure attributable to the ideal lubrication that is maintained in his machine. His choice of lubricants to ensure results is Dixon's and he is using Dixon's graphite automobile lubricants throughout his car. He is not alone in this choice, however, many of the other speedway celebrities using the same brand.

BOSTON ORPHANS ON OUTING.

Nearly 2000 crippled and orphan children from the public institutions of Greater Boston were recently taken to nearby Nantasket Beach in motor cars as guests of the Boston Automobile Dealers' Association, the cars being loaned by private individuals and motor car companies of the city.

This year's event was the banner outing of all the nine annual affairs held by the association under personal direction of Chester I. Campbell, the man who has made such a success in the management of the Boston Automobile Show. There was no discrimination in the choice of children as regards race, color or creed, and all the youngsters mingled in their games in the mostly friendly fashion. While the children frolicked on the beach the operators of cars engaged in athletic games. At noon all sat down to a bountiful dinner, as the association's guests, and late in the afternoon were taken back to Boston, tired, but happy.

LINCOLN HIGHWAY NOTES.

The complete Official Road Guide of the Lincoln Highway, 1916 edition, is being sent out to thousands of transcontinental tourists in all sections of the country.

In this edition there is complete information for the tourist who intends to take the ocean to ocean tour over the Lincoln Highway. The book, which is interesting in every detail and attractively arranged, is published in a handy pocket size with leather binding.



Orphan Children at Nantasket Beach as Guests of the Boston Automobile Dealers' Association, Where They Were Taken by Automobile.



Do not fail to give attention to the fan, as it is an important factor in cooling the motor. The principal care is to keep the belt at the proper tension and not to adjust it either too tightly or too loosely. Provision is made in the majority of cars for the taking up of the slack. The usual method is by the use of an eccentric as shown in Fig. 192. To increase the tension of a fan belt the locking nut is loosened and the eccentric partially rotated. It will be well to bear in mind that if the belt is adjusted too tightly, the fan bearings will be subject to undue stresses. After making the proper adjustment do not forget to lock the eccentric. It is also well to inspect the fan bearings from time to time, because should they become worn the fan may work near the radiator and the blades cut into the part.

UNIQUE COOLING SYSTEM.

As a motorist becomes more experienced in operation, he frequently makes improvements so that the life of certain parts may be lengthened. A car was noticed recently in a New England city which had a funnel incorporated in each rear mud guard, as shown in Fig. 193. When questioned concerning the arrangement the operator stated that the tires contacting with the road generated intense heat, especially on warm days and because of their sheltered position behind the guards could not be properly cooled. With a funnel inserted in each rear guard, as shown in the illustration, a volume of air is taken in through the large opening and passes out through the spout, so that a stream of cool air is directed on the tire at all times when the machine is in motion. As the funnels were painted the same color as the mud guards they were inconspicuous.

EMERGENCY TAIL LIGHT.

A Massachusetts motorist writes that recently his car figured in an accident which smashed the rear light beyond repair. Being at night and not wishing to chance arrest, he resorted to the method illustrated in Fig. 194. The electric trouble light was uncoiled from under the dash and a piece of red wrapping paper, which he secured from a nearby store, was placed across the lens. Friction tape was used to hold the paper in place. The trouble light was then se-

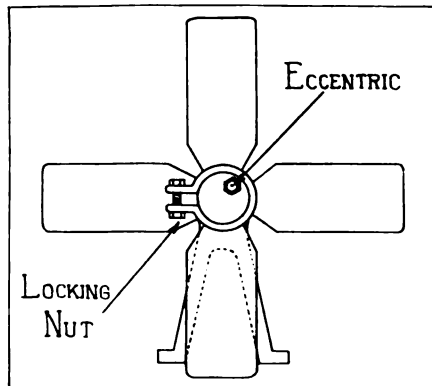


Fig. 192—Illustrating the Conventional Method of Maintaining the Proper Tension of the Fan Belt.

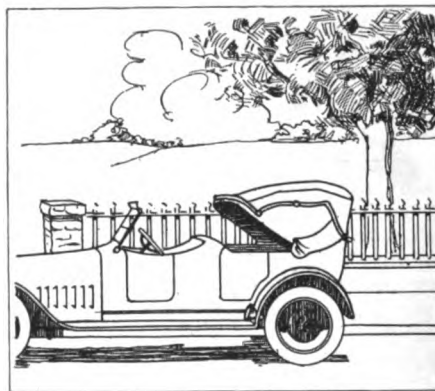


Fig. 193—A Novel Device Adapted by a Motorist to Cool Tires by Directing a Volume of Air Against Them.

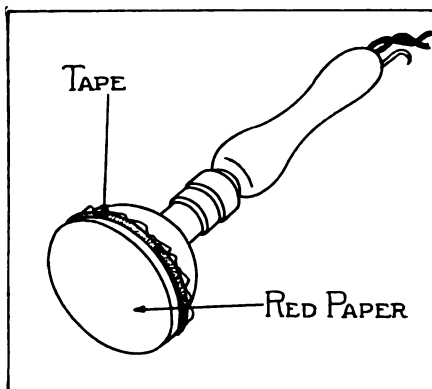


Fig. 194—An Emergency Tail Light Contrived Out of an Electric Trouble Light.

cured to the rear of the car, the cable running from the electric light socket on the dash. Of course there was no white light showing at the side, but it is a good substitute in an emergency and there is not much danger of being troubled by the police.

ETCHING IRON AND STEEL.

To establish ownership of their tools many mechanics inscribe their name on them. Instead of using a stamp for the purpose, it is the better plan to place the name on the tool by etching process by using a solution made of one ounce of muriatic acid and a half ounce of nitric acid. Cover the place to be marked with melted beeswax and then make the desired markings through the wax to the metal with a sharp pointed instrument. Shake the solution well and apply it to the indented letters with the end of a feather. Allow the acid to remain until it has eaten into the metal to the desired depth. The action of the acid can then be neutralized by sprinkling water over the part.

CASE HARDENING HINT.

When case hardening a wheel or other component of a piece of work and it is desired to leave one portion soft, so that it can be machined, the following suggestion may prove helpful: Before placing the work in the furnace, the part desired to be kept soft should be covered with a layer of old fire clay. After the heating process do not remove the fire clay, but allow it to remain in position until the work has become cool.

PAPER GASKETS.

The most satisfactory gasket to use for cylinder heads are those made and designed especially for the purpose. If, however, the motorist is in urgent need of one and cannot readily obtain it, a satisfactory substitute can be made of heavy wrapping paper, which should be cut to the required dimensions and then soaked in boiled oil for about 10 hours. The gasket should then be hung up and allowed to drip, after which some flake graphite should be sprinkled on its surfaces. This type of gasket will afford a tight and durable joint.

RAISING THE CAR.

Repair men often place jacks under the frame of the car when it is necessary to remove the rear assembly, a practise which requires blocking of the front wheels. Care must also be taken that the body is not touched, as very slight pressure would cause the car to fall off the jacks. A simpler method of raising and holding the rear of the car steady is illustrated in Fig. 195. This suggestion can only be adopted, however, when there is a chain fall attached to the ceiling of the room. The top of the car is lowered and the tonneau floor board removed. Next cut from a plank four inches wide and about $2\frac{1}{2}$ inches deep a length that will tightly wedge into the channel steel frame of the chassis. The board should be rounded at the edges as shown at A, so that it can be driven with a hammer into the frame. A sling can then be placed around the board and then placed in the hook of the chain fall. The advantage of this method is that it is impossible for the car to be pushed over.

CRANKSHAFT LAPPING TOOL.

When the lower connecting rod bearings do not receive sufficient lubrication the crankshaft journals are apt to become scored, especially when bronze bearings are used. Journals in this condition should be trued and the tool shown in Fig. 196 A will greatly facilitate this operation. It consists of two blocks of wood about the same width as the journal and of sufficient length so that when in operation the cranks will not touch the ends.

Each section of the wood is bored to suit the diameter of the work and the two pieces joined at the ends with a small hinge. The crankshaft is then placed in the lathe and a piece of fine emery cloth inserted in the hole of the tool. Place the tool over the journal and by operating the lathe at a medium speed, the unevenness of the metal will soon be removed.

ALIGNING GAUGE.

To facilitate steering and insure against excessive tire wear, it is essential that the alignment of the front wheels be tested periodically. In Fig. 196 B is illustrated a type of gauge which has given satisfactory service for a number of years in a large Rhode Island garage. The arms or extremities are made from pieces of $\frac{1}{2}$ -inch square steel, and the two guides are blocks of steel which have been drilled and then broached or filed to receive the arms. As can be seen in the illustration, one of the blocks is pinned to the end of the lower arm. Any adjustment of the gauge can be made by loosening the winged nuts at the top of the guides and moving the arms in or out as the case may require. The ends of the arms are ground to a point so that the measurement may be obtained to a high degree of accuracy.

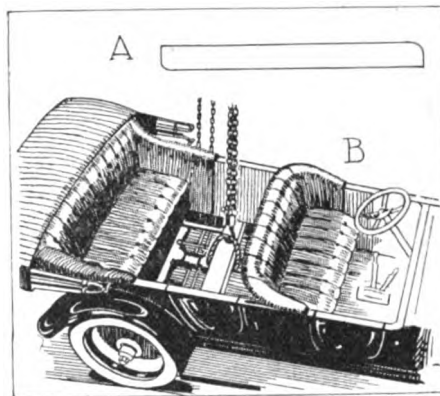


Fig. 195—A Practical Means of Raising the Car When a Chain Fall Is Available.

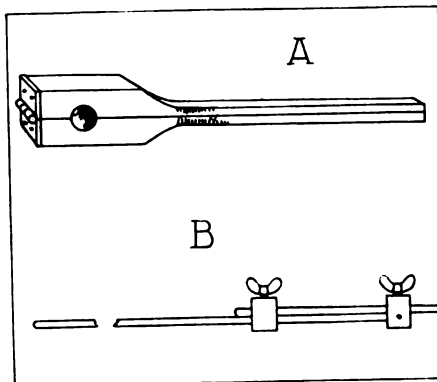


Fig. 196—A, Home Made Crankshaft Lapping Tool; B, Simple Aligning Gauge with Which Measurements Can Be Obtained with Great Accuracy.

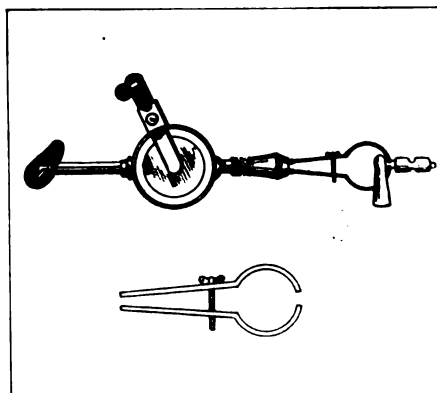


Fig. 197—A Tool Designed to Facilitate the Labor of Grinding in Petcocks. Showing the Tool Separate and Assembled in a Breast Drill.

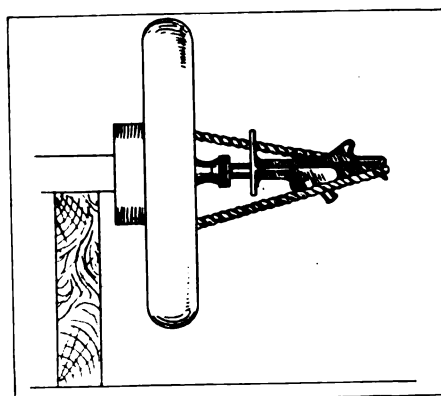


Fig. 198—An Emergency Wheel Puller for Roadside Repairs, Consisting of a Jack, Metal Bar and Piece of Rope.

GRINDING IN PETCOCKS.

A slightly worn petcock in the gasoline line will allow considerable fuel to leak away if the defect is not promptly attended to. Grinding the male member in its seat with a paste made of powdered glass and lubricating oil is generally an effective remedy. If this work is to be done by the usual hand method considerable time will be required. In Fig. 197 is illustrated a device for facilitating the operation.

The clamp consists of two pieces of sheet steel about five inches long, $\frac{3}{4}$ inch wide and $\frac{1}{8}$ inch thick. The ends are ground to fit the chuck of a breast drill, while a V slot is ground in the jaw ends. The construction is extremely simple, the petcock being held firmly in the auxiliary jaws by a thumb screw. By rotating the handle of the drill the valve member may be ground in easily. The direction of rotation should be reversed frequently.

SUBSTITUTE WHEEL PULLER.

When the semi-floating type of rear axle is used it is impossible to remove the driving wheels without employing some kind of a puller. There are specially designed tools for this purpose, but they are usually garage or repair shop equipment and are seldom if ever included in the tool kit of the car. Should it ever be necessary to remove a rear wheel while on the road and in the absence of a specially constructed puller, the suggestion illustrated in Fig. 198 will be found helpful.

Jack up the wheel to be removed and block the axle so that the wheel is free of the ground. Remove the hub cap and retaining nut and then fasten a rope to opposite spokes as shown. Place a short piece of stock against the end of the axle shaft, the base of the jack against the stock and the head of the jack in contact with the rope. By operating the jack in the usual manner the rope will be drawn sufficiently tight to pull off the wheel. If the wheel does not readily come off under this treatment, sharp tapping on a piece of wood placed against the jack head will move it.

DETERMINING TIRE PRESSURE.

A tire expert advises that the correct operating pressure of a tire can be determined without the use of a tire gauge. He states that the weight of cars and the construction and weight of tires vary vastly, and under such conditions it is almost an impossibility to advise any definite pressure.

The method suggested is to disregard entirely the internal pressure and depend on the distention or displacement of the tire. When the car is loaded to the desired capacity, measure the top of the tire and then inflate or let out air as the case may require, so that the bottom of the tire, the point which contacts with the road, measures about nine per cent. greater than at the top. This, he states, is the correct operating condition.

MOTOR CAR ACCESSORIES AND EQUIPMENT.

NO-LEAK-O PISTON RINGS.

The most economical operation of a truck, tractor, automobile, etc., is only obtained when the greatest amount of



power is produced while using the least amount of gasoline and oil. Some piston rings are an important factor in the waste of power, in that the oil and gasoline vapor are permitted to leak through the open slots. The No-Leak-O concentric, one-piece piston ring, illustrated herewith, is of a design that is said to remedy this condition. Each ring has a groove cut at right angle with the face and sloping downward. This groove is quite deep and holds sufficient oil to insure a perfect compression seal, as well as perfect lubrication without waste. The volume of oil packed in the groove prevents surplus oil passing up into the firing chamber on the down stroke, thus preventing a waste of lubricant and the formation of carbon. The oil in the groove also prevents any leak of gas on the compression stroke.

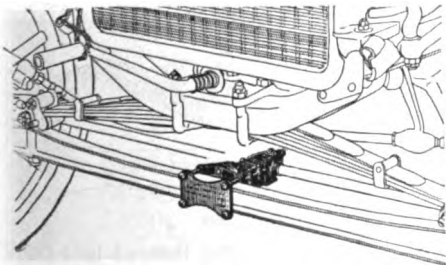
No-Leak-O rings are easy to install and are made of a superior grade of cast iron. The ends of the rings meet in a step-lap joint.

Manufactured by the Automobile Accessories Company, 816 West North avenue, Baltimore, Md. Write for price list.

SAFETY DEVICE.

The Savidge device is an attachment for use on Ford cars which has proven its efficiency to thousands of owners during the past year. Its purpose is to add to the safety and comfort in driving and aid materially in keeping the car centered in the road. Statement is made that it prevents the car from turning corners too sharply, buckling under and that it also takes up all jar in the steering wheel.

The equipment is small and attaches to the front axle and tie rod in the centre of the car in such a manner as to be



practically invisible. The working mechanism is completely enclosed and operates in an oil bath. Attachment can be

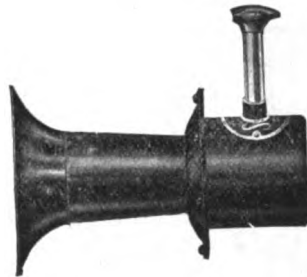
effected by anyone very quickly and without marring the car.

Marketed by the Meixell Company, Merchants Bank building, Indianapolis, Ind. List price, \$4.90.

THUNDER HORNS.

Motorists will do well to investigate Thunder horns, one of which is illustrated herewith. The cardinal feature of these instruments is that there are no gears in their construction and that they are of the mechanical type, possessing great strength and beautiful finish.

The plunger is a round, heavy rod of steel, machined, hardened and ground to size. The knob is of steel, nicked and polished, and is of sufficient size to withstand rough usage and is guaranteed against breakage or becoming detached from the plunger. The rotor is of hardened steel, thus insuring long life. All bearings are long and the weight of the rotor and the thrust is taken by a ball thrust collar. The diaphragm is of vanadium steel and produces the great-



est number of vibrations possible to the minute.

A short turn of the knob produces a soft, pleasing note, while depressing the plunger will produce a long, deep roll, which will compel instant attention.

Manufactured by the Sears-Cross Company, Bush Terminal, N. Y. List price of nine-inch length, \$4; 10-inch length, \$5, and six-inch length or truck model, \$4.

PIPE JOINT COMPOUND.

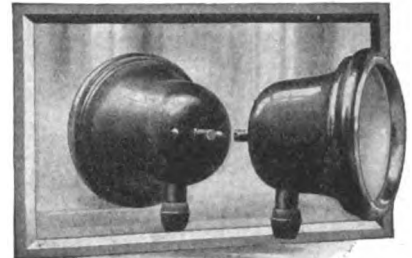
Dixon's graphite pipe joint compound allows the threads of screw joints to move so easily upon one another that a close, tight connection can be readily made. It is useful for steam, water and gasoline piping. A notable feature is that there is no tendency for the compound to set, but allows joints to be easily opened at any time without damage to tools or fittings.

In addition to use on threads of pipes, it is valuable for nuts, bolts, studs, gaskets, etc., as it prevents rust and resists corrosion of all kinds. Prepared in four-ounce collapsible tubes for automobile use and also in one and five-pound tin cans. Larger packages can be obtained if desired.

Manufactured by the Joseph Dixon Crucible Company, Jersey City, N. J. Write for prices.

ELECTRIC LIGHTS FOR FORD.

Illustrated herewith is the Guide electric sidelight, which is especially adapted to Ford cars and is said to be distinct-



tively "Ford" in appearance. A pair of these lights can be easily attached and operated on a multiple connected dry battery or storage battery. They afford strong light and are especially desirable for city driving. The bracket is of the standard Ford type. The lamps are finished in black, with a nickel rim.

Manufactured by the Guide Motor Lamp Manufacturing Company, Cleveland, O. List price, per pair, \$4.50, either single or double contact.

POLSON LEATHER BOOT.

Illustrated herewith is the new outside Polson "hook on boot," designed for use in preventing or holding blow outs in the tire. It is made of heavy frictioned fabric vulcanized over a tire form and on top is a tread of heavy chrome leather thickly studded with hardened steel studs. The fabric body is said to eliminate all stretching. Each boot is furnished with a set of adjustable hooks, which provides a simple yet positive adjustment for fitting the boot to stretched or oversize tires.

Manufactured by the Polson Rubber Company, Cleveland, O., and Kansas City, Mo. List price, three-inch size, \$1.30; 3½-inch, \$1.40; four-inch, \$1.50; 4½-inch, \$1.70, and five-inch, \$1.90.

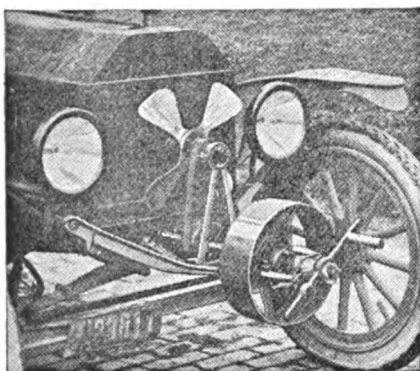
HARNESSING THE FORD.

One of the most practical devices ever produced for the farmer is a power attachment for the Ford car, which has been given the trade name "Autopow." This equipment bolts on the front of the



Ford car, converting it into a stationary power plant which will operate almost any piece of stationary farm machinery, by belting it in the regular manner. Statement is made that this power plant

will run a grain grinder, wood saw, water pump, straw cutter, fanning mill, hay press, wood pulper, ensilage cutter, grain separator, oat flaker, grindstone, churn, cream separator, emery stand,



concrete mixer or small machine shop.

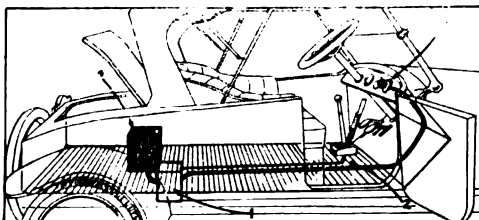
Claim is made that using the Ford in this manner does not strain the motor or cause it to overheat. An extra fan is provided for the front of the radiator to assist cooling. The drive shaft connects to the front of the crankshaft through a flexible joint or coupling. The pull of the belt is taken by a large bearing located next to the pulley at the outer end of the bracket, and, therefore, the motor receives none of this strain. The pulley runs loose on the shaft, so that the belt may be slipped on, then the load is engaged by throwing in a clutch which grips the pulley.

Farmers and others will readily understand the value of this equipment. It can be installed without machine work and does not deface or injure the car in any way. As can be seen in the accompanying illustration the car can be used on the road with the "Autopow" attached if desired.

Manufactured by the Autopower Company, 965 Woodward avenue, Detroit, Mich. List price, \$48.

ARNOLD AUTO ALARM.

Because of the steady increase in the number of stolen machines, every car owner should provide some means for protecting his property. The Arnold auto alarm, shown in the accompanying illustration, causes the continuous ringing of a bell if an attempt is made to operate car by anyone other than the person who has the key to operate the lock. A steel box with the ringing mechanism



anism and bell is placed under the car, while the battery is in another steel box under the seat. A special Yale lock switch is fitted on the dash. The ringing mechanism is connected with the

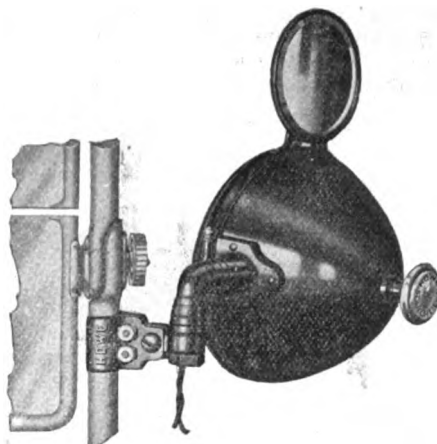
emergency brake and when the lock is turned on, should the emergency brake be released, the bell will ring. No part of the system can be tampered without instant detection. Cutting the wire running to the brake lever, or cutting the cable running to the switch, results in the continued ringing of the bell.

Manufactured by Arnold & Arnold, 501 Rush street, Chicago, Ill. Write for prices and illustrated literature.

HOWE SEARCHLIGHT.

The cardinal feature of the Howe searchlight is that it is mounted on a universal joint bracket embodying coil springs designed to provide constant tension on the joints. This construction allows the lamp to be moved readily, but insures its always remaining fixed in the position placed. The wiring is protected by the hollow bracket.

Manufactured by the Howe Manufacturing Company, 57-61 East Twenty-Fourth street, Chicago, Ill. List price,



\$7.50, and \$9 when fitted with rear view mirror.

SPARK PLUG BOOK.

The manufacturer of the Vesuvius, Superior and Spit Fire spark plugs, announces the 1916 edition of "Mosler on Spark Plugs," a reference book that lists all automobiles, both pleasure and commercial, tractors, motorcycles, etc.

This book has been compiled with great care and the listing includes not only the style and type of plug best suited for individual motors, but also shows the various ignitions and devotes considerable space to the proposition of spark gaps.

The book is for the convenience of the jobber, dealer and car owner and contains a mass of valuable information.

Published by A. R. Mosler & Company, Mount Vernon, N. Y. Sent free upon request to those who mention this publication when writing.

ROBE RAIL BAG.

The Atlas bag, shown in the accompanying illustration, is designed to be suspended from the car robe rail, but

does not in any manner interfere with the use of the same. It is arranged to hold various articles, such as dusters, side curtains, road maps, caps, goggles, thermos bottle, cigars, etc. The bag is



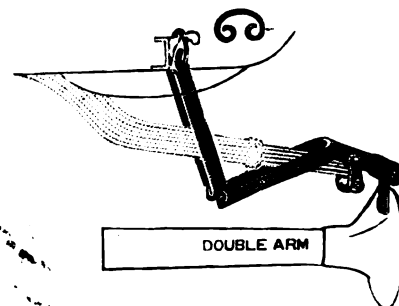
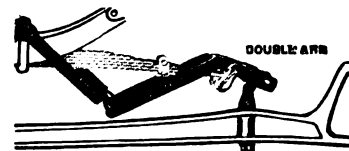
divided into two large compartments and on the outside are two large and two small pockets. The device is well bound, absolutely water proof and presents a handsome appearance. It is 24 inches high and 18 inches wide.

Manufactured by the Atlas Specialty Manufacturing Company, Chicago, Ill. List price of double texture mackintosh bag, \$3.50; fabric leather, \$4.25; patent leather finished duck, \$3; genuine melodeon rubber cloth, \$3.25.

CANTILEVER SHOCK ABSORBER.

The purpose of the Forgesteel cantilever shock absorber is to prevent bouncing and to give the Ford car the same easy riding qualities of most heavier cars. The principle is slow action, this being because the spring is placed some distance from the end of the car spring, thereby absorbing all shocks from roughness and unevenness of the road before they reach the body of the car. The absorber springs are attached to the body of the car and exert a downward pull of about 500 pounds.

The construction is entirely of steel. The springs are made of oil tempered spring wire and the arms are formed from 1½ inch by ¾ inch steel and taper to the ends. Complete installation is accomplished without machine work.



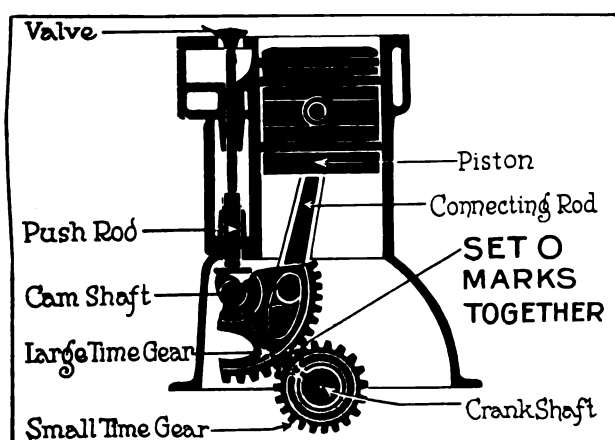
Manufactured by the Home Light Company, 3353 Milwaukee avenue, Chicago, Ill. List price, \$8 for set of four of single arm type and \$10 for double arm model.

SUGGESTIONS FOR THE FORD CAR OWNER.

Reassembling the Engine, the Dynamo and the Transmission Gearset--How to Check the Timing Gears and Valves, Prove the Magnets and Replace the Parts.

The 50th article dealing with the operation, construction, maintenance, care and repair of the model T Ford chassis is the 11th of the series devoted to adjusting, restoration and repair.

WHEN the conditions of the cylinders, pistons, piston rings, wristpins, connecting rods, valves, valve guides, valve ports, camshaft,



Verifying the Relation of the Timing Gears by the Position of the First Cam and Push Rod.

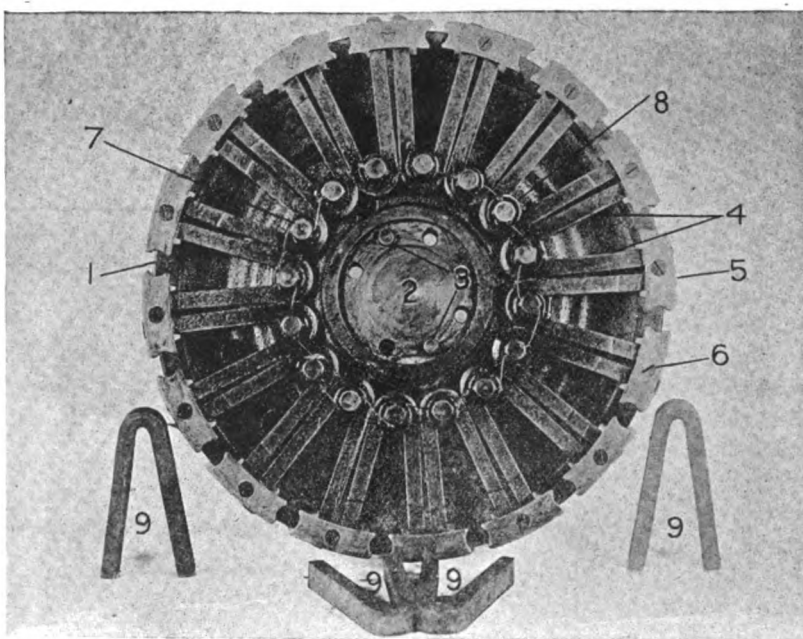
cams, main, connecting rod and camshaft bearings, wristpin bushings and pushrod bushings have been determined, the character of work necessary decided and the restoration of the parts has been made so far as possible, the engine must be assembled and all the parts placed in their correct relation with each other. Much of this assembling is done as the work progresses.

When the crankshaft bearings have been carefully scraped and fitted and with the shaft seated, the caps are bolted to the block. The pistons, with the wristpins and the small ends of the connecting rods in place, are inserted into the cylinders, and then the big ends of the connecting rods are coupled to the shaft and the bolts tightened. The valves are seated in the ports and the springs and collars put on, the springs compressed and the keys inserted.

Care should be taken to lubricate all of the bearings and bushings before the assembling is done, this being to insure two things—first, that there shall be a good film of oil in all the bear-

ings before the caps are tightened, so that the engine may be turned by hand after assembly, and, second, to protect the bearings from cutting or scoring until they are lubricated by the regular circulation of lubricant after the engine has been started. With the main and connecting rod big end bearings well coated with cylinder oil there is little probability that they will be too tight. If the bearings are too tight they must be loosened, a work that can be avoided if there is reasonable care taken in assembling.

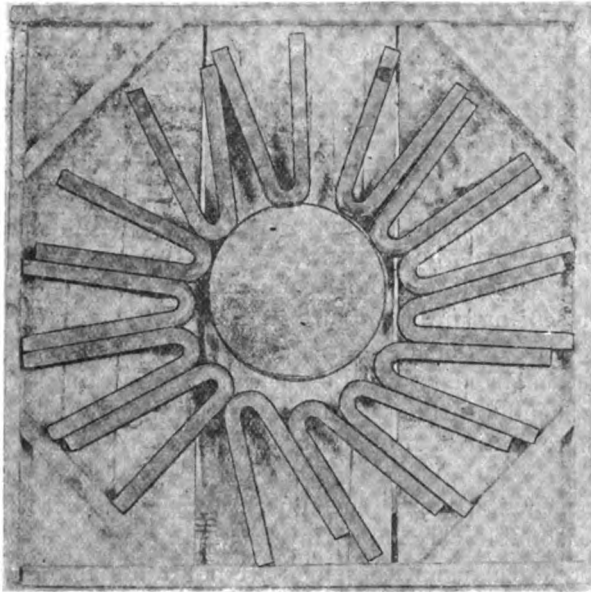
The camshaft bearings are not adjustable and if bushings have been fitted these should have the same degree of lubrication the other bearings are given. If the old bearings are used these should be well oiled. The replacement of the camshaft is not a difficult work, but much care should be taken when doing it. The rear bronze bushing is seated in the engine block, but the others are placed on the camshaft. The centre and front bearings can be identified by their difference in size, the centre bearing being the smaller. The centre bearing is passed through the front bearing seat and to the centre web. With the locking screws, which are used for the centre and front camshaft bearings, removed, the bearings can be easily driven in.



The Flywheel and the Magnets Ready for Installation.

- 1—Flywheel.
- 2—Crankshaft Flange Seat.
- 3—Crankshaft Flange Dowels.
- 4—Magnets.
- 5—Magnet Clamps.

- 6—Magnet Clamp Screw.
- 7—Magnet Bolt.
- 8—Magnet Bolt Washer.
- 9—Magnets to Show General Type.



Board Showing the Manner a Series of Magnets Is Received from the Ford Factory or Branch.

In ordinary overhauling the crankshaft, or small timing gear, which is keyed to the crankshaft with a single key, is not removed. The large, or camshaft timing gear, is retained on the camshaft by two dowels and by a lock nut, and this need not be taken off during an overhaul. In the event of a gear being worn, or teeth broken, either may be removed from the shaft. As there is but a single keyway in the crankshaft, or gear, no mistake can be made in replacing the gear, but the large timing gear could be turned a half revolution with reference to the normal position on the shaft unless care is taken to mark a dowel end and the hole in which it should be placed by punch marks before the timing gear is taken off.

If the gears have been taken off, the outside or forward side of each may be noted by a zero mark on one of the teeth of the crankshaft gear and by a similar mark on the camshaft gear on the rim midway between two teeth. The first cam of the camshaft ought to be diametrically opposite to the zero mark, between the teeth of the camshaft timing gear when the gear is rightly installed on the shaft, and the marked tooth of the crankshaft timing gear is between the two teeth of the camshaft. At this point the cam ought to lift the first push rod and the valve. This condition ought not to be changed in re-assembling the engine, and the position of the cam with reference to the mark on the camshaft timing gear is an absolute check. The relative positions of the zero marks on the gears and

the cam and push rod are shown in an accompanying illustration.

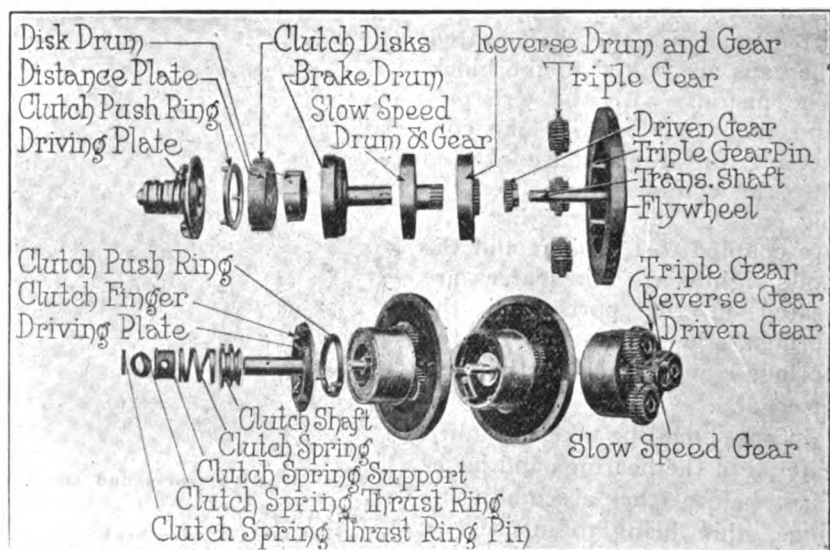
Holding the Push Rods in Place.

If the engine block is in its normal position and the camshaft is to be installed in it, the push rods must be placed in their guides before the shaft and the bearings are cut in. As the guides are vertical the push rods would fall from them without supports. One will find in each push rod a small hole that is approximately level with the top of the guide. A small wire pin can be placed in each hole after the rods are in the guides, which will hold them while the camshaft is being installed, after which the wires can be withdrawn.

The installation of the valves, springs, collars and keys can be made after the camshaft and push rods have been assembled. The process of installing is practically reversal of the disassembling, the same tools being required for this work. After the camshaft is in the block the gearset cover may be put on. When this has been done the engine block is ready for the assembling of the transmission gearset, but before this the oil tube must be run into the block and the dynamo field bolted on. The dynamo field has been described and is probably understood, but it should be examined to learn the condition of the shellac coating, which protects the windings and insulates them. The field ought to be clean and the magneto contact bright. After the field has been bolted to the block and the strap of metal holding the oil tube secured, the assembling of the transmission gearset and flywheel should be begun.

Examination of the Dynamo Magnets.

Preliminary to this the magnets clamped to the flywheel should be carefully examined. These are permanent magnets and ought not to become demagnetized, though such a condition might obtain were a storage battery attached to the magneto terminal, and were they subjected to



The Flywheel and Transmission Components, Showing Them Disassembled, and Partly Assembled in Groups for Restoration.

great heat they might be reduced in power, but these are decidedly uncommon eventualities. The condition of the magnets will undoubtedly be noticed from the quality of ignition current obtained. Should they be weak no good purpose will be served by trying to remagnetize them. Remagnetization could only be done by an expert having facilities for this work. A new set of magnets can be obtained from any Ford branch and from many Ford dealers, which, when received, will be packed in a very thin box in the same order they should be placed on the flywheel.

If the magnets are replaced the new series should be clamped to the flywheel with great care so that they will, when the flywheel is bolted on, be precisely $1/32$ inch from the faces of the coils on the field. The magnets are retained by single cap screws and washers at each vertex and by bronze clamping pieces and bronze screws at the ends. The magnets ought to be spaced exactly and the spacing can be noted with reference to the clamps, there being a lug on each, which lugs are placed between each pair of magnet ends. The magnet ends are supported by brass spools, through which the clamping screws extend, that are known as magneto supports. The magneto cap screws are wired to prevent loosening and the same precaution ought to be taken with the clamping screws, although in the engine of which illustrations for this series of articles were made these screws were riveted.

Assembly of the Magnets.

The assembly of the magnets on the flywheel is not difficult, but care must be taken to insure that they are securely held and that they are rightly placed. Each magnet is marked by a stamped letter on each leg, which indicates the north and south pole, and the clamps should each retain a north and a south pole, so that the series is in that relation through the circumference of the flywheel.

Assembling the Transmission Gearset.

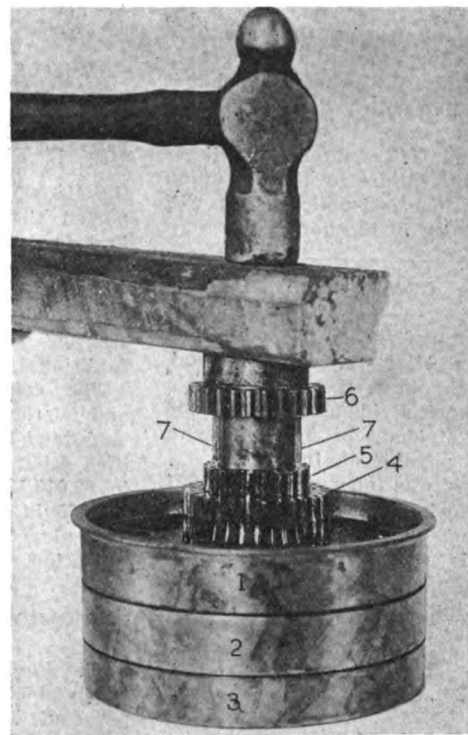
When the flywheel and its magnets are known to be in good condition the assembly of the transmission gearset can be begun. The accompanying illustration of the disassembled parts of the gearset also shows the different groups as assembling progresses. The brake drum is placed on a bench with the sleeve vertical, and the slow speed drum and sleeve is dropped over the brake drum sleeve with the gear on top. The reverse drum is placed over the sleeve of the slow speed drum, so that the reverse gear is outside of the slow speed gear. The two keys that retain the driven gear are set into keyways and the driven gear is put on the end of the brake drum sleeve and is forced down by hammering a block of wood or soft metal placed on the gear. The teeth should be downward when the driven gear is correctly placed.

The three triple gears should be then meshed with the driven gear, correct position and rela-

tion being insured by meshing the teeth of the triple gears with the driven gear in accordance with the punch marks on the teeth of both gears, with the smallest face of the triple gears outside or toward the flywheel. After the gears are correctly meshed a stout cord or wire may be passed around them and securely fastened. If the transmission shaft has been removed from the flywheel, its flange should be placed in the seat in the centre of the flywheel, which is set with the magnets down on a bench.

Putting on the Drum Assembly.

The four bolts that secure the flywheel and transmission shaft are inserted in the flange of the shaft and the flywheel. The drums and triple gears should then be lifted and inverted, the transmission shaft placed in the sleeve of the brake drum and the assembly lowered and the hubs of the triple gears dropped over the shafts



Putting the Driven Gear on the Sleeve of the Brake Drum with a Block of Wood and Hammer.

that carry them. This done, the four bolts and the two dowels of the flywheel should be placed in the flange of the crankshaft and the bolts tightened. If the engine is out of the chassis a quicker and easier manner of assembling is to bolt the transmission shaft and flywheel to the crankshaft flange, and tighten and wire the nuts of the bolts. With the shaft firm, the drum and triple gear assembly can be placed on it and the gears placed on the shafts.

(To Be Continued.)

New York has a law prohibiting the hunting of game from an automobile. The law also prohibits taking game with the aid of car headlights.

HUGE AUTO MERGER ABANDONED.

Overland, Chalmers, Hudson, Auto-Lite and Fisk Combination Meets with Complications--Wilys Explains.

John N. Wilys, president of the Wilys-Overland Company, has announced officially that the plan to merge the Overland, Chalmers, Hudson, Fisk and Auto-Lite companies into a huge holding company, with an approximate capitalization of \$250,000,000, has been abandoned. Mr. Wilys is reported as having made the following statement:

"As the proposition was first put to me I understood that I was to receive payment on a cash basis for the holdings which I would turn over. There would have been no objection to such procedure. When I discovered that the cash was not forthcoming and that it was the intention to carry through the proposition on a different basis, I decided to withdraw."

As regards the rumors that the plan might have fallen afoul of the Sherman anti-trust act, Mr. Wilys asserted that it had nothing to do with the abandonment.

The best of personal feeling between the Durant and Wilys interests still exists, despite the failure to effect a union of forces, and in broad policies they will continue to work in harmony.

AUTO BODY COMPANY DIVIDEND.

The directors of the Auto Body Company, Lansing, Mich., have recommended to the stockholders the payment of a 20 per cent. stock dividend. At the same time a cash dividend of five per cent. was declared, payable on July 1.

The company was incorporated in 1901 with an authorized capital of \$250,000, which was increased last year to \$500,000. There is about \$61,650 stock outstanding of a par value of \$10 a share, on which during recent years cash dividends of 10 per cent. annually have been declared. A bid of 35½ for the shares of the company was made recently on the Detroit Exchange, but none was offered.

The company's plants at Lansing have a capacity of about 200 bodies a day.

BIG AUTO MERGER.

It has been reported in New York financial circles that the Saxon, the Paige, the Grant, the Stearns, the White and the Peerless companies are all included in the merger of 15 large automobile manufacturing concerns into a corporation to be known as the National United Motors Corporation with a capital of \$75,000,000.

No information as to the officers of the new corporation has been given out, except that a New York banker will be president and that the details of the merger were worked out by P. F. Vorkamp of Detroit, assisted by Charles C. Neal. It is also reported that the negotiations for the merger have been com-

pleted and that some of the largest bankers in the western cities will underwrite the proposition.

DUPLEX INCREASES STOCK.

The directors of the Duplex-Power Car Company, Charlotte, Mich., advanced the capitalization of the company by 25 per cent. at a recent meeting, and it is expected that in the near future another increase, of the same amount, will be made. This company has experienced a great growth of business and is understood to be planning large additions to its plant. A 10 per cent. dividend was declared a few weeks ago, and another is expected at the annual meeting in August.

WHITE DOING BIG BUSINESS.

Net profits of the White Motor Company for the year ended Dec. 31, 1915, were \$8,700,000, equal to 55 per cent. on the \$18,000,000 capital stock, and it is reported that domestic business for the first four months of 1916 has increased about 45 per cent. over that of a year ago. There are 5000 White trucks in use by the Allied armies, 4000 being in Russia and 1000 at French headquarters. Additional war contracts are pending.

The company's buildings, machinery and current assets value as of Dec. 31 amounted to \$12,537,275, and total liabilities other than capital stock amounted to \$2,013,120, leaving a balance of \$10,524,155 in net tangible assets, which is equivalent to 66 per cent. on the capitalization.

PACKARD DECLARES BIG DIVIDEND.

The Packard Motor Car Company recently declared a stock dividend of 50 per cent. on the common stock, payable Aug. 1 to holders of record June 16. The amount of common stock now outstanding is \$7,771,830. At the same meeting of the directors Henry B. Joy was formally elected chairman of the board and Alvan Macauley president of the company.

In an interview President Macauley denied rumors that the Packard company had entered, or was about to enter, any of the prevalent combinations or consolidations, and said that no such combination is either pending or contemplated.

DU PONT BUYS FAIRFIELD CO.

The Du Pont Fabrikoid Company, Wilmington, Del., has purchased the Fairfield Rubber Company, whose plants are at Fairfield, Conn. The Fairfield company manufactures a coated textile similar to Fabrikoid and it is used extensively by automobile and carriage manufac-

turers. All the present employees will be retained, the change effecting only the owners. The company will continue under its old name. J. K. Rodges, sales manager of the Du Pont Fabrikoid Company, will act in the same capacity for the Fairfield company.

SAXON EXCEEDS EXPECTATIONS.

In the 11 months ended in May the Saxon Motor Car Company earned \$1,250,000 net, which is equivalent to 20.8 per cent. on \$6,000,000 stock outstanding. June is expected to be a record month, in which event the estimate previously announced by President Harry W. Ford of \$1,250,000 for the year will be exceeded.

METZ PLANT BUSY.

The big plant of the Metz Motor Car Company, Waltham, Mass., is being worked to its maximum capacity to meet the large demand for the gearless Metz. At the end of May, which was the largest in the history of the company, train loads of Metz cars were shipped to all parts of the country. The company's plant at Waltham, which is the largest east of Detroit, is one of the most complete in the world for the manufacture of automobiles, practically everything that goes to make up the Metz being manufactured in the four big factories, except the Gray & Davis starting and lighting systems, with which they are equipped, and the Goodrich tires. The company even owns its own timber lands in Vermont, where the lumber used in the bodies is cut.

The factory covers 12 acres of floor space and the total acreage of the property is 137. The smaller parts of the car are made in plant No. 1, where the chassis are assembled. After a road test with temporary wheels it is driven to the Governor Gore plant, where the body, new wheels, windshield and other parts are put on. The upholstering, trimming and top making departments are located in Plant No. 2 and the cars are shipped from Plant No. 3.

Besides the well known pleasure car type, the Metz company also manufactures a commercial vehicle for light delivery which is meeting with popular demand throughout the country.

LEAVES CHEVROLET.

H. Lauterbach, who has been prominently connected with several automobile agencies in New York, has become associated with a number of New York capitalists, who have organized a new company to manufacture a low priced car.

Mr. Lauterbach resigned as sales manager of the New York branch of the Chevrolet Motor Company to take up his new duties. He had previously been connected with the Buick and Studebaker branches.

The name of the new company in which he has become interested has not

been announced, but it is understood that plans have been made to take over a well known factory in the middle west.

BELL MOTOR EXPANDING.

The Bell Motor Car Company, which was organized less than a year ago, has increased its capitalization to \$1,000,000, and has purchased a 15-acre factory site in East York, Penn., at Rockburn station, upon which it is proposed to erect a modern manufacturing plant before the end of the year. The Bell company has been offering a pleasure car and a 1000-pound commercial car and will continue the line in the new location, employing between 500 and 1000 men.

WILLYS ELECTED DIRECTOR.

John N. Willys of the Willys-Overland Company has been elected to the directorate of the Third National Bank of Buffalo, N. Y. William A. Morgan, president of the Buffalo Copper and Brass Rolling Mill, recently acquired an extensive interest in the bank.

BOSCH CLOSES MORE CONTRACTS.

Eight more prominent concerns in the automobile and motor truck industry have closed contracts to use Bosch magnetos during the coming season, the companies being the Mercer Automobile Company of Trenton, N. J., Diamond T Motor Car Company of Chicago, Thomas Everts Adams, Inc., New York City; Detroit-Wyandotte Motor Truck Company, Wyandotte, Mich.; Autocar Company, Ardmore, Penn.; Rochester Carriage Company, Rochester, N. Y.; Stegeman Motor Car Company, Milwaukee; Republic Motor Truck Company, Alma, Mich.

BATES GOES TO KING.

G. J. Bates, formerly with the Firestone Rubber Company, has joined the King Motor Car Company in the capacity of commercial manager, a new executive position, the inauguration of which was announced at the recent banquet tendered to district sales managers by the company at Detroit. Mr. Bates will have supervision of the sales and advertising departments. He was with the Firestone company for three years, handling accounts in Michigan, and with the Diamond Rubber Company for seven years as a department manager.

MACMULLEN JOINS CHALMERS.

B. J. MacMullen, well known as an automobile sales executive, has joined the Chalmers Motor Company as assistant sales manager under Frank B. Willis, manager of the sales department. Mr. MacMullen started with the White company in 1907 at the New York City branch, going from there to the Willys-Overland company in 1910 as special representative at the factory. In 1914 he became general manager of the Overland Pacific Coast zone, with headquarters at San Francisco.

STUTZ MOTOR CHANGES HANDS.

Allan A. Ryan of New York, with Other Capitalists Secures Control---H. C. Stutz, Retains Presidency.

Allan A. Ryan of New York and several prominent bankers have secured control of the Stutz Motor Car Company of Indiana and all of the assets and capital stock of the company have become the property of the Stutz Motor Car Company of America, which has been organized to take over the old plant.

H. C. Stutz will be president of the new company and Allan A. Ryan will be vice president. The directors, including Mr. Stutz and Mr. Ryan, are G. H. Saylor of the Chase National Bank; S. A. R. Fletcher, president of the Fletcher American National Bank of Indianapolis; H. F. Campbell and R. E. Maypole. Mr. Campbell, who is chairman of the board, will remain as secretary and treasurer.

The new Stutz company will have an issue of \$75,000 shares of stock, no par value, of which 37,500 shares have been syndicated and will be offered for subscription at \$55 a share. It is also planned to make additions to the plant at Indianapolis which will increase the output from 50 to 100 per cent.

NEW ARGO SALES MANAGER.

W. L. Smith, who has been a distributor and special representative in Washington, D. C., of the Argo Motor Company of Jackson, Mich., has been promoted to the position of director of sales of that company.

He has been head of the Smith Motor Sales Company of Washington and represented the Argo company in the eastern and southern sections of the country.

A. C. VOSBURGH IS DEAD.

A. C. Vosburgh, Syracuse, N. Y., one of the well known figures in the automobile parts manufacturing industry, died Sunday, June 11, at his home in that city. Mr. Vosburgh, who was treasurer of the New Process Gear Corporation of Syracuse and active in its management for the past 10 years, had been ill for over a year.

COLLINS IN NEW AUTO COMPANY.

The Wolverine Automobile Company, Toledo, O., which is headed by A. H. Collins, formerly vice president of the new R. C. H. Corporation, has purchased a factory and nine acres of ground in that city. It is planned to turn out a new type of sport car and production is expected to begin early in July.

BLAIR LEAVES S. K. F.

F. R. Blair, formerly secretary, treasurer and sales manager of the S. K. F. Ball Bearing Company, Hartford, Conn., has resigned to become president of the F. R. Blair & Co., Inc., with offices at 50

Church street, New York City. It is understood that Mr. Blair is engaged in developing motor efficiency devices.

MILLER INCREASES CAPITAL.

The capital stock of the Miller Rubber Company, Akron, O., has been increased from \$2,000,000 to \$20,000,000. Part of the new issue will be issued as a dividend of 66 per cent. to stockholders. The new stock will be both common and preferred and will secure funds for the enlargement of the factory.

COMET COMING IN SEPTEMBER.

The Comet Automobile Company, Rockford, Ill., a newly organized corporation, expects to have its product, the Comet car, on the market in September. The car will have a six-cylinder engine and will sell for \$800. A light truck will also be manufactured.

G. W. Jagers, one time treasurer of the Racine Manufacturing Company of Racine, Wis., is head of the mechanical departments of the new company. Harry R. Sackett and Joseph Callahan of Chicago are president and vice president of the company. Temporary quarters have been secured in the Rockford Trust building at Rockford.

HEADS STEWART-WARNER CO.

At a recent meeting of the directors of the Stewart-Warner Speedometer Corporation, C. B. Smith was elected president of the company to succeed the late J. K. Stewart, who died on June 1. W. J. Zucker was elected vice president and secretary and T. T. Sullivan, vice president and treasurer.

Mr. Smith's elevation to the head of the corporation is no surprise to the trade, as he has been the active head for a number of years and mainly responsible for the aggressive business spirit of the concern.

Mr. Zucker was elected to fill the vacancy on the directorate created by Mr. Stewart's death and L. H. La Chance has been elected chairman of the board.

CHRYSLER MANAGES BUICK.

Walter P. Chrysler, formerly factory manager of the Buick Motor Company, has been appointed general manager of the concern. Mr. Chrysler resigned as factory manager several weeks ago and the announcement of his promotion was not made known until recently, following a visit of W. C. Durant to Flint, Mich., where the factory is located. He succeeds to the position held by Charles W. Nash, which was vacated when the latter resigned as president of the General Motors Company.

INDUSTRIAL NOTES AND COMMENT.

Recent Happenings Among the Makers of Cars and Equipment and Members of Related Industries.

It has been reported that the Grant Motor Car Corporation recently received an order for 4500 of its cars from an automobile company in Paris. The report gained credence when it was learned that the foreign concern had deposited a large sum with a New York City trust company subject to draft on delivery of the cars aboard steamers. The Grant company's plant, which has just been expanded, is understood to be working day and night on the order. Its present daily capacity is about 150 cars.

New Plant for Perlman.

In erecting the new plant for the Perlman Rim Corporation at Jackson, Mich., a new record in speed and economy in construction has been attained by the contractors, the Samuel Austin & Son Company, industrial engineers and builders of Cleveland. The structure is 360 by 100 feet and the walls of steel sash and factory glass from sills to eaves. Through the centre of the plant from front to rear is a superstructure with practically all glass sides, which, together with the glass walls, provide the maximum of light to the interior.

Oakes Adding to Facilities.

The Oakes Company, Indianapolis, maker of automobile parts, accessories and metal stampings, has contracted for a new one-story reinforced concrete building to be erected alongside the present plant. The addition is especially designed for the requirements of the Oakes company and will provide about 50 per cent. more floor space. Occupancy will be possible about Sept. 1.

Studebaker Production Plans.

At the recent convention of Studebaker branch managers at Detroit it was disclosed that factory additions and enlargements will soon make it possible to produce 8000 cars a day normally and 10,000 under forced output. It was also

announced that by July 1 the shipments during the preceding 12 months will have increased to 65,000 cars, which is double the record of the best previous year. About 20 branch managers from all parts of the country attended the convention, which was addressed by the officers and department heads of the corporation.

Franklin Builds Again.

The Franklin Automobile Company, Syracuse, N. Y., has broken ground for another extension to its plant, the new building making the fourth important factory unit started within the past 12 months and providing 143,000 additional square feet of floor space. The structure will span four railroad tracks, permitting loading under cover, and will cost about \$500,000, including machinery. It will be three stories high and of reinforced concrete, with provision for adding three more floors as requirements demand. With this addition the Franklin company will have facilities for producing 50 cars a day.

Implement Builder to Make Bodies.

The Emerson-Brantingham Company, Rockford, Ill., for years recognized as one of the country's leading carriage, farm implement and tractor builders, is planning to install a department for the manufacture of automobile bodies and fenders. This company has abundant capital and one of the most completely equipped factories in America and should be able to market a product that would appeal strongly to the highest class of automobile manufacturing trade.

Chalmers Adding to Plant.

The Chalmers Motor Company is adding about 25 per cent. to its present floor space by erecting the building shown in the accompanying illustration, which is an exact duplicate of the other three main structures. The new unit measures 400 by 60 feet and is four stor-

ies high, costing approximately \$150,000. The factory offices and store rooms will occupy the main floor, while the balance of the building will be devoted to manufacturing, more than \$75,000 in machinery having been purchased for the equipment. The plant will be modern throughout, with several advanced ideas for the employees' comfort and welfare.

Petry Expands Sales Territory.

The American Piston Ring Company, Baltimore, Md., which in the past has been represented in the Atlantic Coast states by the N. A. Petry Company, Philadelphia, has made arrangements so that the latter concern will take control of the sales in all the states east of a line north and south of Denver, Col. The Petry company also handles a muffler cutout and reports that it, as well as the products of the American Piston Company, is meeting with well merited success.

Chandler to Share Profits.

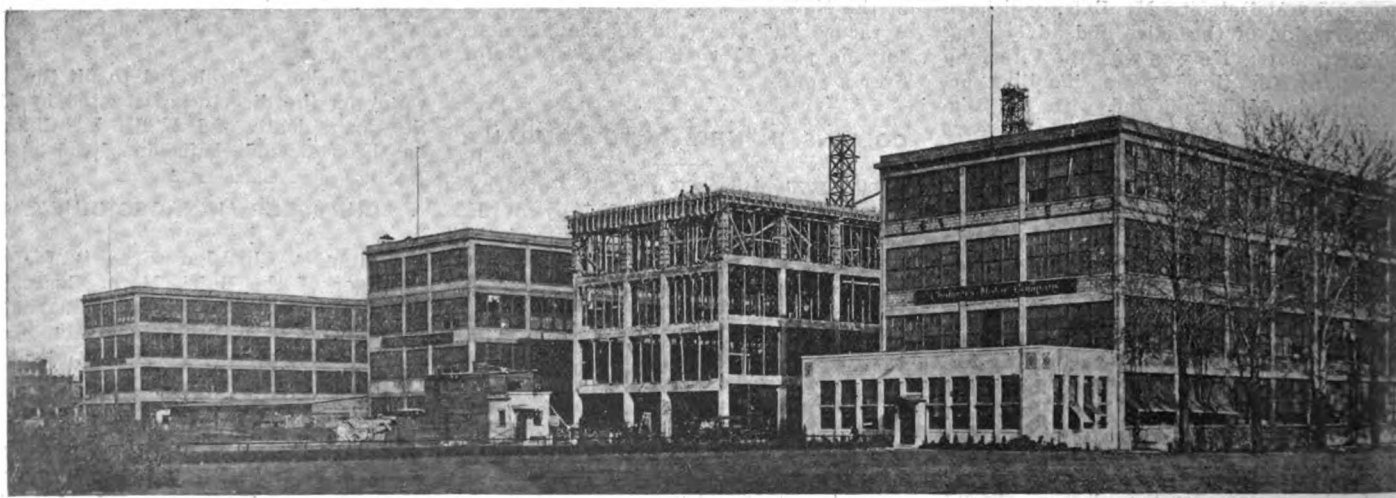
Notices were recently posted in the plant of the Chandler Motor Car Company, Cleveland, that employees would be given a share in the profits earned by the company during the past year. The notices indicate that a sum equal to five per cent. on all wages paid, including overtime, commencing July 1, 1915, and ending June 30, 1916, will be distributed with the July 20 pay roll.

Reo's Drive Away a Success.

Recently 201 dealers and buyers visited the Reo Motor Car Company's plant at Lansing, Mich., during a week and drove away cars to their home towns, the largest number of which were in Michigan. There was a large proportion of visitors, however, who resided in distant states, one being from Lynchburg, Va. R. C. Rueschaw, Reo general sales manager, declares that these drive away events are better than any other form of advertising because of the friendships that spring up between producers and distributors and purchasers.

Farmers Buy Jefferys.

E. G. Soward, sales manager of the Thomas B. Jeffery Company, says that the farmers have been a big factor in



How the Chalmers Motor Company is Adding About 25 Per Cent. to Its Present Floor Space by Erecting the Building Shown Above, Which is an Exact Duplicate of the Other Three Main Structures—It Measures 400 by 60 Feet and is Four Stories High, Costing Approximately \$150,000.

SUMMIT HILL CLIMB CONTEST.

Fourth Annual Event at Uniontown to Have Four Events
for which \$3000 Will Be Awarded.

trebling the demand for Jeffery cars. "The farmer today," Mr. Soward declares, "insists upon a car that will give him luxurious riding comfort, as well as stand up under all kinds of rough going and usage. The farmer at one time in making a car purchase devoted most of his attention to the mechanical details, but he is now following the lead of his city neighbors and pays more attention to appearance."

"An instance of this rural demand is found in the business being done by Charles Sibley, the Jeffery dealer, in Antioch, Ill., a town of only 450 inhabitants. Mr. Sibley has already sold 75 cars, and has many prospects for more sales."

Haynes Believes in Benzol.

In the opinion of Elwood Haynes of the Haynes Automobile Company, benzol is the most probable substitute for gasoline. He declares that the production in this country will amount to 22,000,000 gallons this year, and that if the methods of production are improved this amount could be increased to 600,000,000 gallons yearly.

"The entente powers," said Mr. Haynes, "which are now cut off from the American supply, are using benzol in their military motors without changing the design of the motor or carburetor. The application of benzol as motor fuel must receive a marked impetus in this country at the close of the European war, since the supply that is being consumed in the manufacture of explosives will be diverted to the motor fuel market."

Higher Prices for 1917.

That everything tends towards higher prices for motor cars during the 1917 season if the builders anticipate maintaining the present quality of their cars, is the opinion of H. H. Rice, sales manager of the Nordyke & Marmon Company, Indianapolis, builder of the Marmon cars.

This prediction is based on the present condition of the market for raw materials and the rather unsettled state of the labor market, the prices of both commodities being at the highest level in the history of automobile manufacture. Even at the higher prices manufacturers are said to be experiencing much difficulty in securing supplies.

"We are planning to double our production next season," said Mr. Rice, "and we are already endeavoring to place contracts for supplies. It is surely going to be a matter of getting in orders early if the builders want to get their supplies on time."

Gives Militia Balloon.

The Goodyear Tire and Rubber Company of Akron, O., have presented a \$100,000 balloon to the Ohio Field Artillery, of which Major Harold M. Bush is commander. The balloon is sausage-shaped after the German models and is the only one of its kind in the United States, although the government has ordered several like it. It will be used by the military organization for observation purposes.

The fourth annual Summit Hill climb, to be held at Uniontown, Penn., on July 20, an event which has become well known throughout the United States, will include four contests this year, three automobile and one motorcycle event. There has also been an increase in the prize money, the total awards in the four classes aggregating \$3000. The automobile contests will include the following classes:

Class "E," non-stock—Open to class "C" cars with a piston displacement of 230 cubic inches and under. Entry fee, \$15. Prizes: First, \$200; second, \$100; third, \$50.

Class "E," non-stock—Open to class "C" cars with a piston displacement of 300 cubic inches and under. Entry fee, \$25. Prizes: First, \$400; second, \$200; third, \$100; fourth, \$50.

Class "D," non-stock, free-for-all—Open to any gasoline car which complies with the definition of a motor car. Entry fee, \$50. Prizes: First, \$750; second, \$500; third, \$250; fourth, \$125; fifth, \$50.

The motorcycle event will be as follows:

For professionals, non-stock—Open to motorcycles (close stripped) with a piston displacement of 61 cubic inches and under. Entry fee, \$10. Prizes: First, \$100; second, \$75; third, \$50; fourth, \$25. Entries close July 17th at 8 p. m.

ROAD BOOK OF MAINE.

The fifth annual edition of the Maine Automobile Book, which has just been issued, is far superior to the preceding editions, having 400 pages and covering 200 routes which honeycomb the Pine tree state, the greater part of New Hampshire, most of Massachusetts and New Brunswick and Quebec. For anyone touring through those states it should prove invaluable, as it is carefully and accurately compiled and contains much detail. The particular feature is the itinerary of the famous Pine Tree Tour which is taken annually by hundreds of tourists. There are also 14 city and town street maps, showing the exits and entrances.

The Maine Automobile Association, which publishes the book, sends one to all of the 3000 members of the organization, as well as to the general public. It practically covers New England so far as routes leading into Maine are concerned and also this year outlines through routes between New York City and Maine. A summary of the fish and game laws of the state are an interesting and valuable feature, as well as regulations for motorists entering Canada.

The book is bound in green leatherette with gold embossing and sells for \$1 a copy, including three large touring

maps, which are contained in a pocket in the back cover. For copies address the Touring Bureau of the Maine Automobile Association, 12 Monument square, Portland, Me.

CONCRETE ROAD CONFERENCE.

The proceedings of the Second National Conference on Concrete Road Construction, held in Chicago last February, have been published in book form and constitute a volume of over 300 pages.

The publication is of inestimable value, as it represents a compendium of knowledge of many of the leading authorities on highway construction. It is a complete report of the proceedings of the greatest conference ever held by road building engineers.

Copies of the book may be obtained for \$1 each from the secretary of the National Conference on Concrete Road Building, 111 West Washington street, Chicago.

BAY STATE ANNUAL OUTING.

The annual outing of the members of the Bay State Automobile Association, held at Spofford Lake, N. H., June 17, was attended by over 350 members and their friends. The party spent Saturday and Sunday enjoying all kinds of sports. Russell Greene, chairman of the outing committee, was the first to arrive at the lake, accompanied by the members of the runs and tours committees. George McNear, president of the association, and the other officers, were also early arrivals.

The annual banquet held Saturday night in the Pine Grove Spring hotel was followed by dancing until midnight.

OXIDATION OF CYLINDER OILS.

The Bureau of Standards, Department of Commerce, has issued a pamphlet, Technologic Paper No. 73, giving certain data relative to the oxidation of automobile cylinder oils which have been made the subject of a recent study by that bureau. The rate of oxidation of three oils when exposed to sunlight and air was studied and the increase in weight, acidity and carbonization value, as well as changes in the Maumene and iodine numbers and in the demulsibility, were determined. Changes in the carbonization values of the three oils and of eight others when heated for different lengths of time at a given temperature, and for the same time at different temperatures, were studied. The bearing of the work of the bureau upon the testing of oils is pointed out.

Copies of the paper may be secured free of charge upon application to the Bureau of Standards, Washington, D. C.

CORONER BLAMES MOTORISTS.

Places Onus of Care Upon Drivers of Motor Vehicles and Defines Rights of Pedestrians.

The coroner of New Haven, Conn., Eli Mix, gave out a statement of his findings on the death of a 65-year-old woman who was killed by an automobile, in which he criticised the reckless drivers of motor cars in very vigorous language. In this particular case the motor car was a "jitney," but the coroner's remarks applied to all kinds.

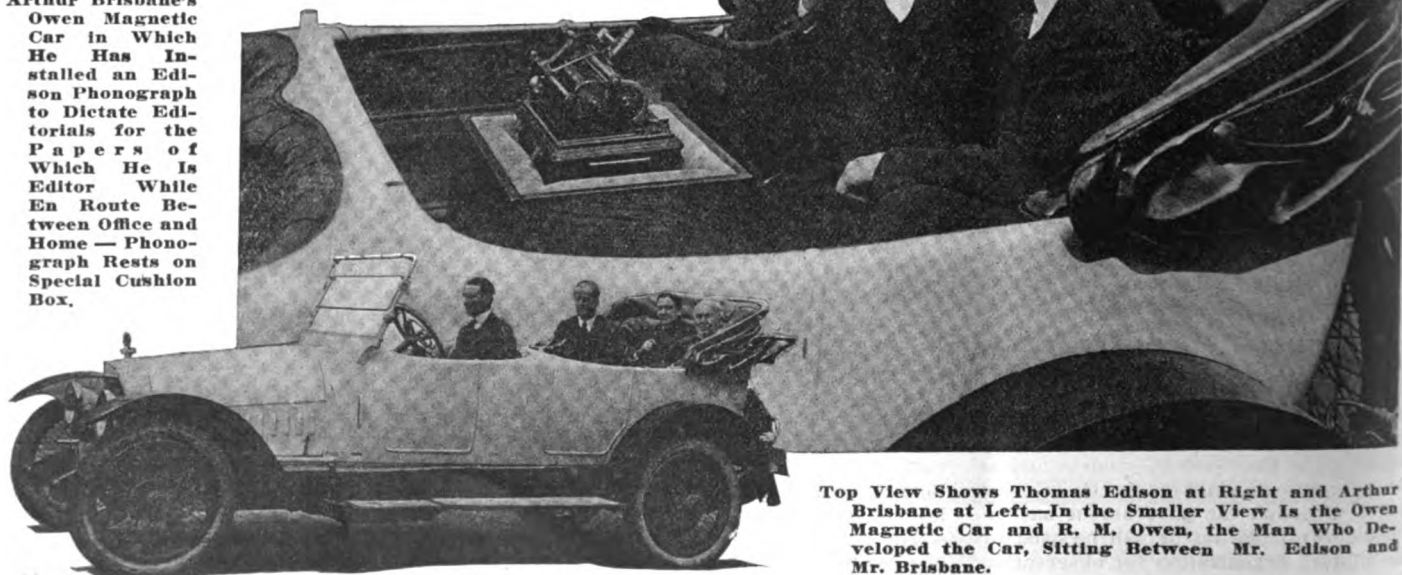
He said in part: "I am of the opinion that a considerable number of drivers of motor vehicles through our city streets operate said vehicles recklessly, paying but little heed to the safety of pedestrians, seemingly believing their responsibility ends by the blowing of the horn attached to such vehicles."

He defined the duties of all classes of travellers on highways, as held by courts, saying in particular that "the pedestrian has the right to assume that the person in charge of a motor vehicle will exercise care and respect for the rights of pedestrians." He characterized the practise of carrying passengers on the running boards as extremely dangerous.

WANT SIGNALS FOR TRAFFIC.

The use of direction signals on motor cars is now being urged by the Safety First Federation of America. It recommends that a signal operating pointers or displaying words be attached to the left rear fender so that drivers following could be informed of the intentions of the operator ahead. It suggests also that a similar signal be used at the front of the car to show pedestrians ahead which way the car is going. At the meeting of the street traffic committee in Cincinnati a signal combined with the tail light was favored. Particular stress was laid on the necessity of such signals

Arthur Brisbane's Owen Magnetic Car in Which He Has Installed an Edison Phonograph to Dictate Editorials for the Papers of Which He Is Editor While En Route Between Office and Home — Phonograph Rests on Special Cushion Box.



Top View Shows Thomas Edison at Right and Arthur Brisbane at Left—In the Smaller View Is the Owen Magnetic Car and R. M. Owen, the Man Who Developed the Car, Sitting Between Mr. Edison and Mr. Brisbane.

for closed cars or cars in which tops and curtains are used, because of the difficulty of hand signaling in such cases.

The probability of laws requiring the use of such devices was discussed and the enactment of such regulations generally was welcomed. The office of consulting engineer to the federation was created and Ernest P. Goodrich, formerly consulting engineer of the Borough of Manhattan, was elected to the position.

PIERCE-ARROWS FOR 1917.

The Pierce-Arrow Motor Car Company of Buffalo, N. Y., announces that in its 1917 output they will adhere to the six-cylinder type of power plant as used at present. In making this announcement it is explained that this decision was arrived at because the six-cylinder type of engine is more efficient.

The official announcement made by the company was:

"No question of price, no discussion of selling argument, enters into the verdict. The issue is one of merit alone. The decision of the engineering staff follows a close observation of motor experiments and tendencies in the United States and Europe.

"If Pierce-Arrow engineers had concluded that extra cylinders could be added with advantage to the operation of the car, such cylinders would have been part of the new output. Every resource of capital, labor and mechanical equip-

ment are available for the purpose at the great Buffalo factory.

"The only rule for production is that the output shall embody the utmost in service and luxury. Price is an afterthought not to be determined till the car has been made to represent the best."

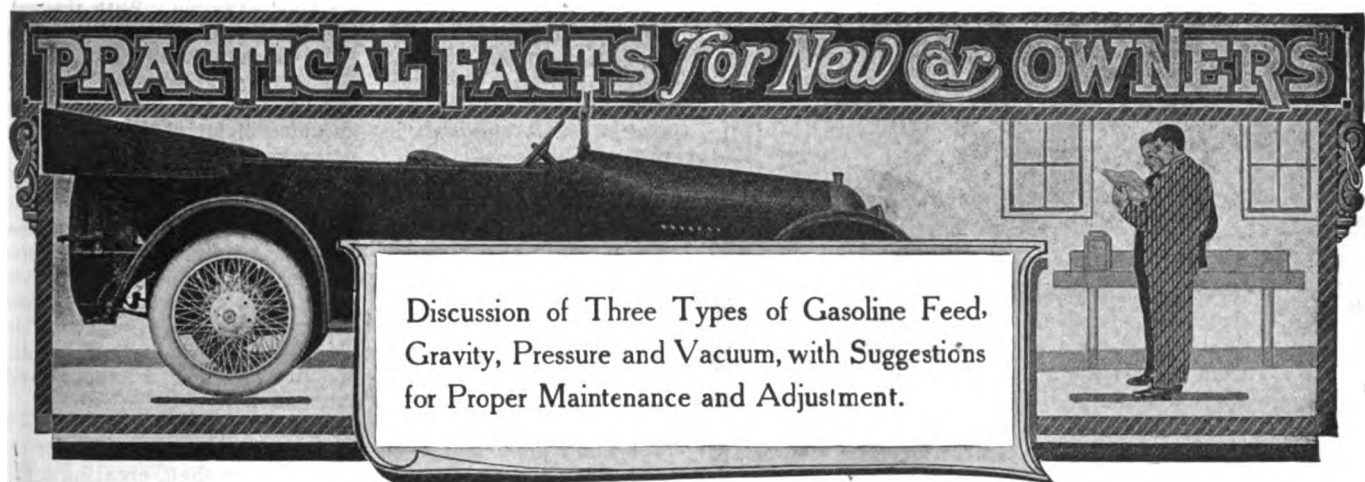
251 DU PONT PRODUCTS.

An interesting and valuable book just off the press is the Du Pont Products Booklet, which is bound in blue Fabri-koid and lists 251 distinct commodities produced by the Du Pont companies. Each commodity is graphically described, as is its purpose and the different employments to which it is adaptable. There are several of these products that have become standard in the manufacture and repair of motor cars and for that reason motorists, repair men and manufacturers will find it of considerable value as a reference book.

TO CLOSE AUTO TRUNK LINE.

During four months of this year the Hancock road, the trunk line for automobiles between Pittsfield, Mass., and Albany, N. Y., will be closed for rebuilding, according to an announcement made by the Massachusetts Highway Commission, which is intending to put down a concrete surface.

It will be necessary for travellers to make a detour to Richmond and Queechy Lake, N. Y., to reach Albany from the east over the Jacob's Ladder route. The Monument Mountain road from Stockbridge to Great Barrington, will be closed, but there is a good road along the Housatonic river through Glendale and Housatonic.



THE following discussion of the several methods by which gasoline is fed to the carburetor is not intended to draw critical comparisons between the systems in vogue, but rather to acquaint uninitiated motorists with the principles of operation. The systems now generally used may be classified as gravity, pressure and vacuum.

The gravity system is based upon the law of nature that liquids seek the lowest level. This system is extremely simple and a question often brought up as a consequence is, "Why is it not universally adopted?" If an automobile were always to travel on level roads it would prove the ideal method of gasoline feed, but inasmuch as there are steep grades to be negotiated there are several objections to its adaptation. This is because as the car climbs a steep hill the tank at the rear is lower than the carburetor and consequently the gasoline does not flow forward.

Early Systems Were Troublesome.

In the early makes of machines, when the storage tank was nearly always located in the rear, fuel feed troubles were very common; because of the distance between the tank and the carburetor it required only a slight grade to check the gravity flow. The trouble has been generally overcome by placing the tank further front, generally under the front seat, and when in this location only the very steepest of grades are apt to stop the flow of fuel.

With the advent of starting and lighting systems, space was needed for installing the storage battery and consequently some designers incorporated the tank in the dash, while others moved it to the rear of the chassis. Other reasons for many manufacturers changing the position of the tank are that the public desired more storage space and the tank could not be located sufficiently high on the underslung models. Advocates of this system state that simplicity and readiness are its chief advantages. The disadvantages are that the fluid is apt to splash through the vent hole in the filler cap and that when filling the tank, if any gasoline is spilled, it either runs on the seat, on the engine or down the side of the car.

In the accompanying illustration is shown a general type of gravity feed gasoline system. The tank is located under

the front seat. The sediment cup or separator, shown at the bottom of the tank, serves for collecting foreign matter that would otherwise be carried along with the gasoline into the carburetor.

Designers who changed from the gravity system usually located the tank at the rear of the chassis, forcing the fluid to the carburetor by air pressure. Many methods are utilized to accomplish this end, but the principle involved is invariably the same. One of the first methods to be adopted was to utilize the pressure of the exhaust, but because of a great many difficulties this system gradually gave way to a positive air pump usually driven by the engine.

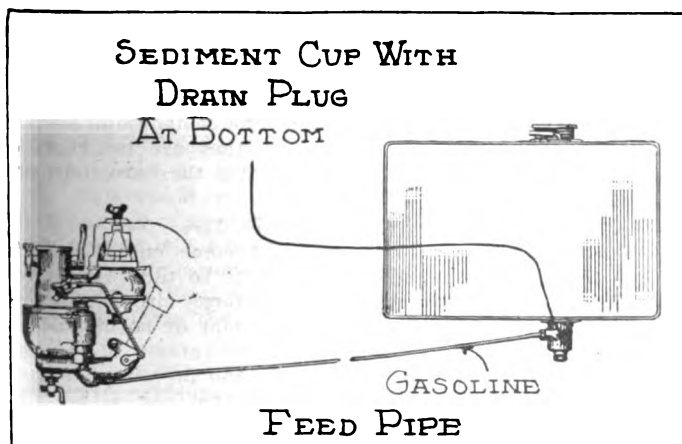
Illustrated herewith is the gasoline system used in the Oakland car. It consists of a gasoline tank located at the rear of the chassis, a line leading from the tank to the carburetor, a pressure pump on the dash and an air line that connects at one end to a power driven pump and at the other end to the storage tank. Two pounds air pressure is required to force the gasoline from the tank to the carburetor. This is obtained in two ways, either by the hand pump located on the dash or by the pressure pump operated by the crankshaft of the motor.

How to Use Hand Pump.

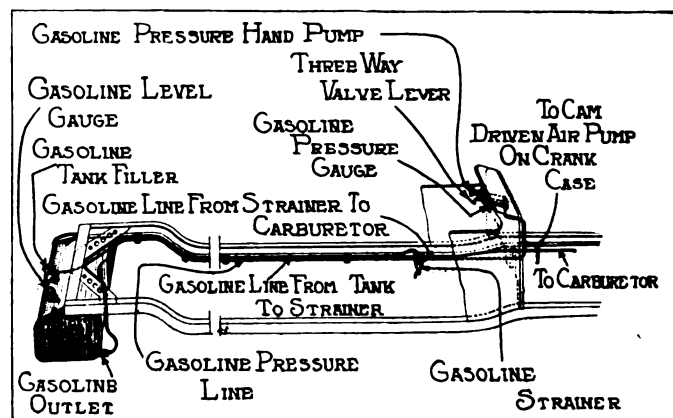
Under ordinary driving conditions the power driven pump produces sufficient pressure, but when fuel has been placed in the tank it will be necessary to use the hand pump to obtain the initial pressure. Before attempting to use the hand pump, the handle of the small cock located just below the pump handle must be turned to the right, so that it is pointing straight across the car. When the pressure has been raised to the desired amount, as indicated by the gauge located near the pump handle, the handle of the cock should be turned at right angles, so as to point downward. By turning the handle to the left so that it points directly across the car, the pressure in the tank may be reduced.

The air pressure system insures a positive feed to the carburetor regardless of the position of the car. Its only disadvantages are that the initial pressure must be produced by the hand pump and frequent inspection of the system is necessary to prevent air leaks.

The next and last system to be described is the vacuum



Illustrating the Gravity Feed System of Fuel Supply.



The Main Features of the Pressure Feed System.

EISEMANN

MAGNETOS

The performance of any motor, however good, will be spoiled by undependable ignition. The manufacturers know this. They won't take chances. This is why Eisemann Magnetos have been adopted as standard equipment by 108 manufacturers of Trucks, Tractors, Pleasure Cars, etc! Eisemann Ignition is powerful, dependable, a guarantee of a

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at low speed, at high speed, at any speed!



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Burns Natural or Artificial Gas
Needs Be Lit but Once a Year—Pilot Light
No Gas or Fumes Can Enter Heater

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Peerless Quality in Smaller Size

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FOUR AT \$2,000 (Sixes \$250 Extra)
THE PEERLESS MOTOR CAR CO., CLEVELAND, OHIO
Makers also of the "48-Six" and Peerless Trucks.
Licensed under The Kardo Patents.

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Briscoe Twenty four. \$625, electric starting and lighting; full equipment.
Briscoe De Luxe Eight 38 \$985; Four 38 \$785.
Write or wire.

BRISCOE MOTOR CORPORATION, 157 Leroy Ave., Jackson, Mich.

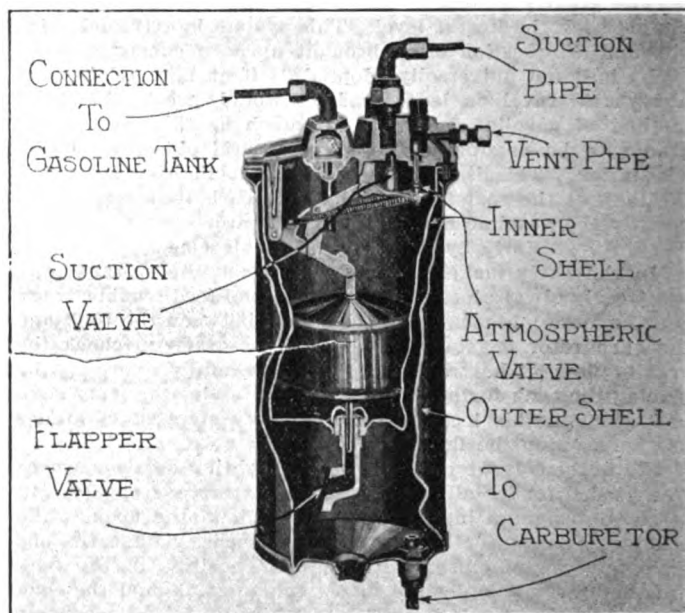
(When Writing to Advertisers, Please Mention The Automobile Journal.)

feed, of which the Stewart is a good example. With this system the main storage tank is usually carried at the rear of the chassis, from which the fuel is transferred by suction to a small auxiliary tank near the engine. From here the fluid flows to the carburetor by gravity. The vacuum system is the latest development and is not difficult to understand, as the principles involved are but elementary.

Principles of Vacuum System.

In the accompanying illustration is shown the vacuum tank used on the Buick 1916 models. It consists of two steel shells, the inner one of which contains the float and valve mechanism, attached to the cover. The inner shell is connected to the gasoline tank, the intake manifold, and is open to the atmosphere by means of a vent tube on the dash. The outer and larger shell connects only to the carburetor and the atmosphere. The two tanks are joined by a flapper check valve in the bottom of the inner shell.

In operation, when the float is down, the suction valve is open and the atmospheric valve closed. The suction of the motor is now communicated to the inner shell, creating a partial vacuum, and drawing gasoline into the tank from the main reservoir at the rear of the car. As the tank fills the float rises, until, at a certain point, the springs close the suction valve, at the same time opening the atmospheric valve. The gasoline which has been drawn into the inner shell now flows down into the outer shell through the flapper valve, and



Components of Vacuum Tank of the Vacuum Feed System.

from there to the carburetor as fast as needed. When the inner tank is empty and the float down, the position of the valves is reversed, the fuel again following into the inner tank.

The action of the tank is entirely automatic. If at any time it should be filled to a point that causes the suction line to draw gasoline into the intake manifold, the trouble is most likely due to a leaky float. In that case the float will become filled with the liquid and be too heavy to act, the result being that the suction valve is constantly open. The float should just be of sufficient weight to draw the operating lever, to which the springs are attached, past the centre point. If not, stretching the springs slightly when they are too tight, or cutting a small piece from the end when they are too loose, will remedy the difficulty.

Suggestions for Proper Care.

To fill the tank, should it ever become entirely empty, close the throttle and allow the engine to turn over a few times with the electric starter. If in those circumstances it is impossible to fill it, prime with a pint or so of gasoline through the filler plug on top. The advantages of this system are that it combines the gravity and pressure feeds, allows more carrying space by placing the tank at the rear of the car, and affords a positive feed to the carburetor regardless of the level of the car.

ENCLOSED SPEEDOMETER DRIVE.

It is interesting to note that at present many car manufacturers are giving attention to little features, one of which is the speedometer drive. Formerly on the majority of cars the speedometer drive was on the front wheel. The drive was exposed and often developed noise and gave trouble by the wearing of the gears. The noted improvement is the enclosing of the speedometer drive. The Marmon 34 has this feature the speedometer drive being in back of the transmission. The totally enclosed bronze gears operate in oil, are noiseless and keep in perfect alignment.

PRESERVING TIRES

Automobile drivers can greatly prolong the life of the tires by driving slowly around corners, keeping them free from oil, vulcanizing cuts as soon as they appear and by maintaining the air pressure specified by the manufacturer.

REMOVING CARBON.

Oxygen is recognized as one of the most satisfactory agents for removing carbon from the cylinders. However, there are certain factors which should be remembered in conjunction with its use. The motor should be turned over until the piston is at the extreme top centre, because at any other point the intense heat would roughen the cylinder walls. Do not allow the flame to strike the spark plug hole threads, as it will damage them. During the operation keep the cooling system filled with water.

**CARBURETOR TROUBLE.**

(A. F. R., Harrisburg, Penn.)

I have a 1911 Cadillac car which is fitted with a model L Schebler carburetor. At a speed of 10 to 12 miles per hour the motor will miss regardless of any adjustments which I may make at the carburetor. At a speed of 20 to 30 miles per hour the motor runs without a miss. I also notice that when the engine is shut off, gasoline will drain from the bottom of the carburetor. I have examined the gasoline level and find it to be O. K. I also examined the engine, but could not locate the trouble. I fitted a hot air intake, but this did not improve conditions except when the engine was very hot. Would a later model L carburetor eliminate this trouble?

On a 1916 model car equipped with a Delco single-unit, six-volt battery, I am troubled with the headlight bulbs burning out. I was told that this was caused by loose connections in the circuit. Is this correct?

Examine the spark plugs. The gap between the electrodes should be about 1/32 of an inch wide. A wider gap than this would cause missing at low speeds and perhaps perfect ignition at high speeds. The reason for this is that a stronger current is produced at high engine speeds. If the valve guides have become worn, surplus air will be drawn in by the suction of the piston and thus greatly weaken the mixture. This would cause missing at low speed because of the small amount of gas taken into the cylinder. When the throttle is opened wider a greater amount of gas is admitted and the surplus air cannot weaken it sufficiently to cause the engine to miss. Leaky manifold joints would cause the same effect. Examine the wiring and note that all terminals are tight.

If there is not a pin hole in the float chamber, it is almost conclusive evidence that the leaking from the base of the carburetor is caused by the needle valve not properly seating to shut off the supply from the storage tank. This condition would, however, effect the level, but at the time you ex-

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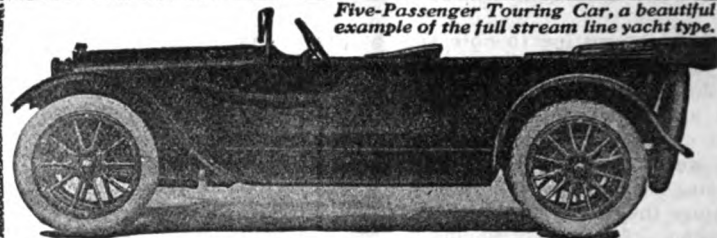
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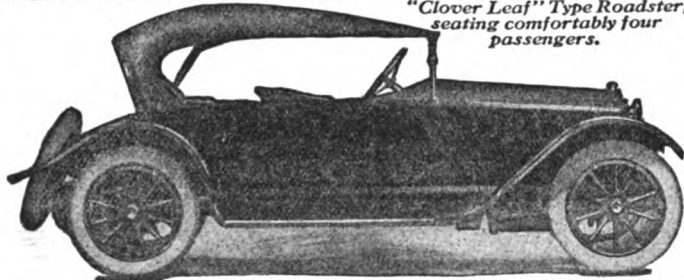
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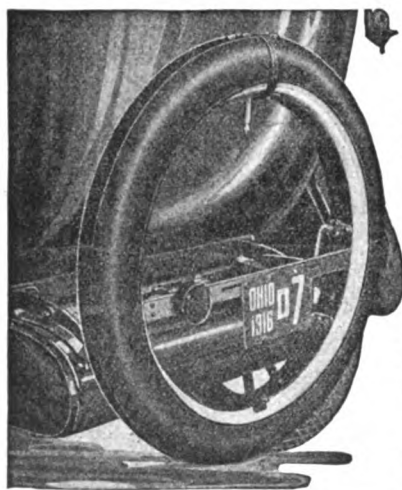
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MADE OF EXTRA HEAVY LEATHER CLOTH

We will send water bucket only postpaid for 50 cents, or inner tube case only for 50 cents.

All we ask is for you to show them to your dealer.

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Vice-Pres. & Gen. Mgr.

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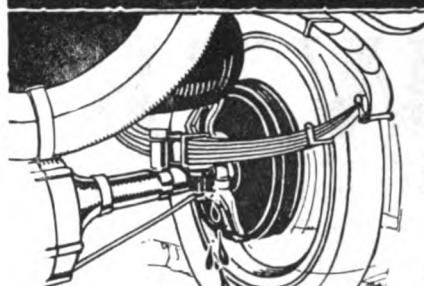
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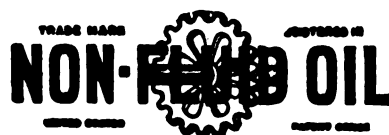
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Its density is scientifically correct for the proper lubrication of all gears and bearings. This density is fixed and unchangeable—NON-FLUID OIL will not melt at high temperatures.

NON-FLUID OIL lengthens the life of your car because it is killing friction always—the very instant the car starts—and every instant it is in motion.

Use "K No.00 Special" grade for gears; "K No.000" for bearings. Sold only in orange-colored cans—at best dealers.

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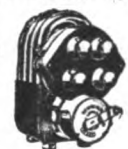
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POWER

The power developed by your engine is in direct proportion to the precision of your ignition.

Missing—from fouled plugs
—cuts down power.

Incomplete combustion—from
a weak spark
—cuts down power.

Leakage of compression around
or through the plugs
—cuts down power.

If you want relief from all these motor boat engine worries—

If you want a hot, fat spark all the time—

If you want freedom from carbonized and broken insulators and loss of compression—

If you want your engine to develop its full rated power—install

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Proven by radical tests. Practically Trouble Proof. You are fully protected by the following:

"We guarantee Master Calorite Spark Plugs against defects of material or workmanship and will replace free of charge any Calorite Insulators broken by heat which are returned to us transportation prepaid."

Master Calorite Spark Plugs will not break under extreme changes in temperature. Will not leak compression. Will spark freely on a very weak current.

We have tested them in every variety of service and we know.

Six Styles—Half Inch Regular— $\frac{3}{4}$ Inch Regular—Metric—Model "F" for Fords and Reos— $\frac{3}{4}$ Inches Long—Half Inch Long.

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amined it probably sufficient fuel had not leaked by to raise it. It is a frequent occurrence for carburetors to drip gasoline after standing for an hour or so. Repair men refer to this condition as "seeping." By this is meant that the fluid very slowly works by the needle valve and in time causes it to drain out. The remedy is to reseal the needle valve.

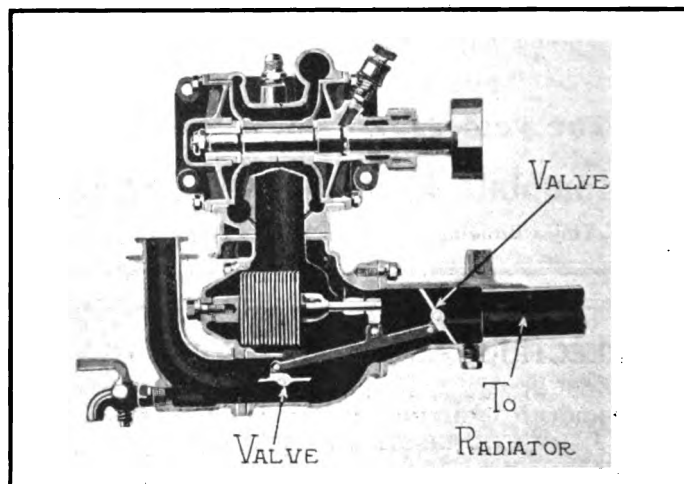
Loose connections in the circuit could not possibly cause the headlight bulbs to burn out. Would advise that you examine the wiring for a short circuit. Frequently the wires touch at the point where they fasten to the connector. The remedy is, of course, to tape one of the bare wires.

THERMOSTAT IN PACKARD COOLING SYSTEM.

(H. M. J., Mapleville, R. I.)

While listening to the conversation of a number of chauffeurs, I came to understand that the Packard Twin-Six has some mechanism in the cooling system whereby the water is not permitted to return to the radiator until the engine has heated sufficiently for smooth operation. Can you explain to me how this is accomplished and if it is done automatically?

In the Packard Twin-Six there is a thermostat attached to the lower side of the pump housing, which prevents the water from circulating through the radiator until it has attained the proper temperature for efficient running. You can better understand the principle involved by referring to the accompanying illustration. When the water in the cooling system is cold, the circulation from the centrifugal water pump is through the cylinder blocks and back to the pump through the by-pass manifold at the rear of the cylinders. As



Thermostat Installed in Packard Twin-Six Cooling System Allows Water Around Cylinders to Become Quickly Warmed.

the temperature of the water rises the thermostat is caused to expand and actuate a lever in the thermostat housing, thus automatically closing a valve in the inlet passage from the rear cylinder block manifold and simultaneously opening the valve in the passage leading from the bottom tank of the reservoir. The water is then allowed to circulate through the radiator to facilitate keeping it at a predetermined temperature. The action is entirely automatic.

TEACHING THE BEGINNER.

(I-O. Co., Quincy, Ill.)

As a general rule, is it better to teach beginners who purchase automobiles to drive with the hand throttle or the foot accelerator? If both, just about how much use should be made of the foot accelerator? Which system is the best for the car and the most satisfactory for the driver?

The writer has had considerable experience in teaching new car owners to operate their machines and he believes the beginner should always be advised to use the hand throttle. There are several reasons for this. The first is that the driver is not acquainted with the location of the controlling parts. He should be instructed to keep both feet on the pedals so that the car can be brought instantly to a stop should the emergency require such. On the other hand, if he was operating the car by the use of the foot accelerator, when taking his foot off to place it on the pedal, he generally looks down

to locate the pedal. The new driver is naturally nervous and the momentary detraction of his attention from the roadway has been the cause of many accidents.

Another point to be considered is that the new driver has not the sense of touch that the experienced operator possesses. Too great a pressure applied to the foot accelerator at the wrong time may result in accident.

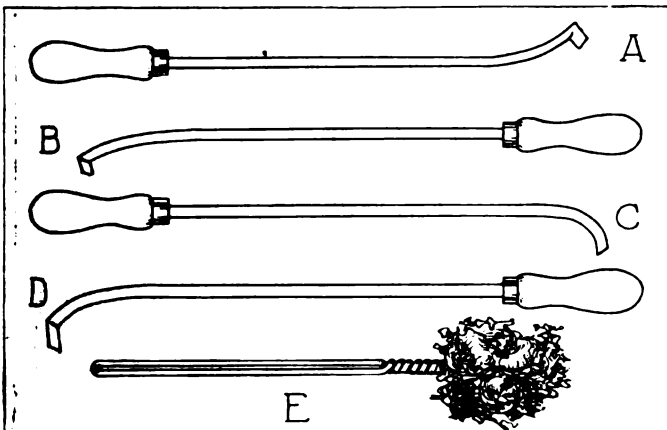
For the experienced operator the foot accelerator no doubt affords the best control of the car. It is easier to manipulate and is extremely handy when operating in congested places.

CYLINDER CARBON SCRAPERS.

(Dr. H. J. P., Ragersville, O.)

In The Automobile Journal of April 25th, of which I am a reader, you have kindly answered my question on page 44. Could I blow the carbon out of the cylinder head with a good auto pump to which I would attach a long rubber hose and then wipe the cylinder clean with a cloth saturated with coal oil? Please give me a description of the required carbon scrapers.

It is doubtful if you could develop sufficient pressure with a hand pump to expel the loose carbon from the cylinders. It is not absolutely necessary that air be used to force the carbon from the engine, this method being suggested because it is the simplest where facilities will permit its use. A satisfactory method is to fasten a piece of dry waste to the end of a wire and then rub it around the cylinder several times. The loose carbon has a tendency to adhere to the waste. By repeating this operation three or four times most of the carbon will be removed. The remainder will be forced out with



A, B, C, D, Different Forms of Scrapers for Removing Carbon from Cylinders; E, Dry Waste Secured to the End of a Wire Will Assist in Removing Loose Carbon.

the exhaust gases when the engine is running.

In the accompanying illustration are shown four different types of carbon scrapers. These can be purchased at any accessory store or if you are handy with the hammer you will be able to make them yourself. They consist of pieces of $\frac{1}{4}$ -inch steel, flattened and ground at the end and then bent to the desired shape. The scraping end should be hardened.

REAL MEANING OF THE CYCLE.

"Cycle" is one of the most misunderstood terms used in connection with automobile mechanics. It will be remembered that the piston must travel through four complete strokes for the deliverance of one power impulse to the crankshaft. This type of engine is used almost exclusively in automobiles and is often referred to as a four-cycle engine. This term is misleading, as the real definition of a cycle refers to a series of operations, hence it would seem that the proper term to apply to this type of power plant is "four-stroke-cycle."

In the majority of cases the motor used in small boats is of the two-stroke cycle type, that is, the piston works through two strokes or one revolution of the crankshaft for the deliverance of a single power impulse to the shaft. It is the practice for automobile writers to refer to an engine as either being of the two or four-cycle type. Do not be confused, however; these are not exactly correct terms, as motors are either of the two-stroke or four-stroke cycle kind.

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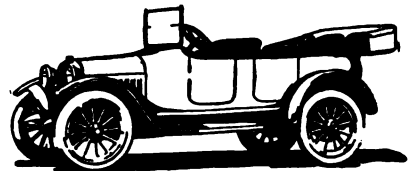
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SCRIPPS-BOOTH

cars have established a new field for luxurious light roadsters. You may judge their value by their standard of ownership.

Roadster \$825.

Coupe \$1450.

ELECTRICITY.

(E. H. P., Stony Point, Penn.)

Will you explain as clearly as possible the difference between the terms volts and amperes?

Volt is the term used to indicate the pressure or force of an electric current, in the same manner as the pressure of water is stated in pounds. The volt has a certain fixed value, exactly as a pound means a certain fixed weight.

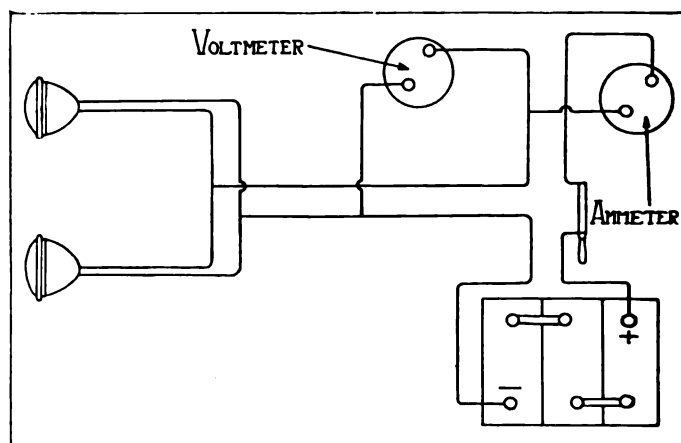
The ampere is the unit or measure of the rate at which the current flows. The flow of current is stated in amperes in the same way that the flow of water is expressed in gallons.

AMMETER AND VOLTMETER.

(G. S., Moosup, Conn.)

Being an interested reader of your valued publication, I am appealing to you to straighten out a little matter for me. It is advised that to determine the condition of dry cells an ammeter should be used and a voltmeter for testing a storage battery cell. Instruction books state that the ammeter cannot be used for measuring the storage battery, yet the voltmeter can be used on dry cells. I also notice that it is common practise to install ammeters in the lighting circuit on cars. These are confusing to me and if possible will you favor me with a clear explanation on the matter?

The ammeter is used for determining the condition of a dry cell by short circuiting it across the terminals for an instant. The internal resistance of dry cells is comparatively

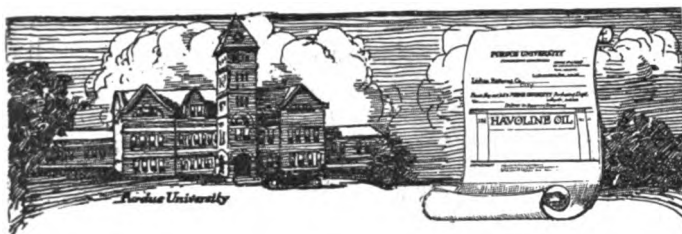


Wiring Diagram Incorporating a Voltmeter and Ammeter in the Lighting Circuit.

high and the chemical action comparatively slow. In the storage battery the conditions are the reverse, the chemical action is very rapid and the internal resistance very low when its elements are connected. Rapid chemical action is productive of heat. It should be borne in mind that in charging a storage battery there is a difference in potential between the negative and positive plates and if the plates were joined together the difference in potential would instantly become equalized. It is this process of equalizing that gives off the current and makes the battery useful. Thus it is desirable that the cells be discharged slowly.

An ammeter is of such low resistance that connecting it across the terminals of a storage battery would produce practically the same condition as directly connecting the plates together. For this reason a voltmeter is used because it has high resistance.

Regarding the ammeters used in lighting circuits, you will note that the maximum reading of the scale is from 15 to 20, and that provision is made for registering the rate of charge and discharge. These instruments do not indicate the capacity of the storage battery, but instead register the amount of current being charged into or drawn from the cells. In the accompanying illustration is shown an ammeter and voltmeter incorporated in the lighting circuit. The voltmeter indicates the strength of the current, while the ammeter shows the amount being drawn for heating the lamp filaments. This amount is small in comparison with that capable of being supplied by the battery.



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Get Them
Send for our new dealer proposition—It's a bummer. Get it now. Ask for copies of our booklet, "Havoline Oil Goes To College," to give your customers.

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Large airy suites of from two to five rooms (also single rooms).

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RATES:—\$1.50 per day, each person
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BOULEVARD ROADSTER
\$955

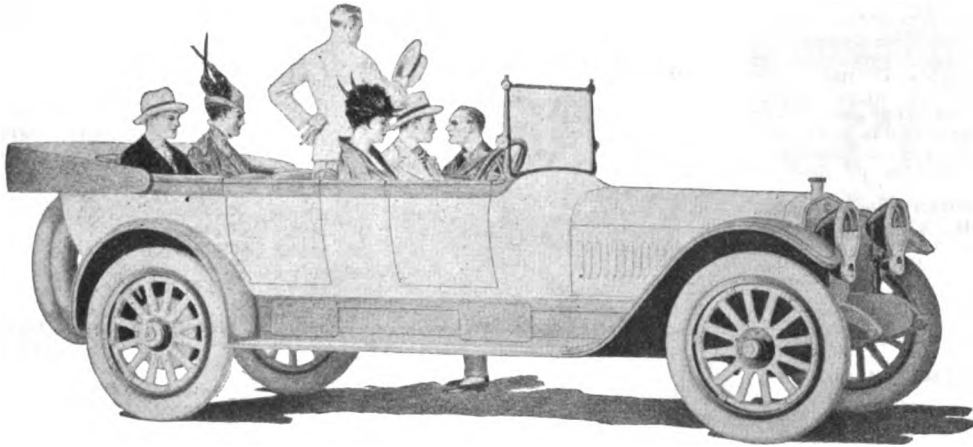
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Individuality is the mark of highest mechanical quality; distinctive beauty belongs exclusively to cars of mechanical superiority.

The Winton Company

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Directory of Touring Information

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The several routings presented below indicate the manner in which the itineraries in this number may be utilized in planning additional tours. Obviously, it would prove impracticable to list more than a very small proportion of the possible tours which might be arranged in this manner, and it is assumed that with this guide the tourist will have no difficulty in making his own plans as he desires.

BALTIMORE, MD.—BRETTON WOODS, N. H.

	Page	Miles
Baltimore to	9	196.0
Bretton Woods	28	392.6
Total Mileage		588.6

BOSTON, MASS.—SAN FRANCISCO, CAL.

	Page	Miles
Boston to	36	190.6
Pittsfield, Mass.	32	40.9
Hudson, N. Y.	45	38.1
Albany, N. Y.	43	307.6
Chicago	46	578.0
San Francisco	5	2664.8
Total Mileage		3823.3

BOSTON, MASS.—ST. LOUIS, MO.

	Page	Miles
Boston to	29	245.7
New York	9	1053.6
St. Louis		
Total Mileage		1299.3

BOSTON, MASS.—MONTREAL, QUE.

	Page	Miles
Boston to	29	149.9
Portland, Me.		459.9
Montreal		
Total Mileage		606.1

BUFFALO, N. Y.—ATLANTIC CITY, N. J.

	Page	Miles
Buffalo to	43	307.6
Albany	45	149.3
New York	39	153.5
Atlantic City		
Total Mileage		610.4

BURLINGTON, VT.—BOSTON, MASS.

	Page	Miles
Burlington to	32	161.0
Bretton Woods	29	187.2
Boston		
Total Mileage		348.2

BURLINGTON, VT.—WASHINGTON, D. C.

	Page	Miles
Burlington to	32	325.7
New York	9	235.0
Washington		
Total Mileage		670.7

CHICAGO, ILL.—ATLANTIC CITY, N. J.

	Page	Miles
Chicago to	4	897.1
New York	39	153.5
Atlantic City		
Total Mileage		1050.6

CHICAGO, ILL.—BALTIMORE, MD.

	Page	Miles
Chicago to	20	196.9
Indianapolis	9	615.2
Baltimore		
Total Mileage		812.1

CHICAGO-GALVESTON, TEX.

	Page	Miles
Chicago to	45	333.8
St. Louis	10	299.9
Kansas City	16	78.5
Topeka	48	1111.5
Galveston		
Total Mileage		1824.7

CLEVELAND, O.—CHEYENNE, WYO.

	Page	Miles
Cleveland to	46	388.1
Chicago	5	1232.3
Cheyenne		
Total Mileage		1610.4

CLEVELAND, O.—MONTREAL, QUE.

	Page	Miles
Cleveland to	46	191.9
Buffalo	43	538.6
Montreal		
Total Mileage		720.5

DAYTON, O.—BRETTON WOODS, N. H.

	Page	Miles
Dayton to	9	702.6
New York	28	395.6
Bretton Woods		
Total Mileage		1098.2

DENVER, COL.—JACKSONVILLE, FLA.

	Page	Miles
Denver to	5	1132.1
Chicago	20	1250.0
Jacksonville		
Total Mileage		2382.1

DETROIT, MICH.—SEATTLE, WASH.

	Page	Miles
Detroit to	47	314.3
Chicago	14	2409.4
Seattle		
Total Mileage		2723.7

DETROIT-NEW YORK.

	Page	Miles
Detroit to	47	294.7
Buffalo	43	307.6
Albany	45	149.3
New York		
Total Mileage		796.6

HARTFORD, CONN.—LAKE GEORGE, N. Y.

	Page	Miles
Hartford to	36	75.1
Pittsfield	32	40.9
Hudson	45	99.0
Lake George		
Total Mileage		215.0

HARTFORD, CONN.—ATLANTIC CITY, N. J.

	Page	Miles
Hartford to	34	124.3
New York	39	153.5
Atlantic City		
Total Mileage		277.8

INDIANAPOLIS, IND.—BOSTON, MASS.

	Page	Miles
Indianapolis to	9	811.2
New York	29	245.7
Boston		
Total Mileage		1056.9

KANSAS CITY, MO.—SPOKANE, WASH.

	Page	Miles
Kansas City to	10	134.1
Emporia	48	736.4
Fargo	14	1309.5
Spokane		
Total Mileage		2180.0

MINNEAPOLIS, MINN.—WASHINGTON, D. C.

	Page	Miles
Minneapolis to	14	488.4
Chicago	20	196.9
Indianapolis	9	576.2
Washington		
Total Mileage		1261.5

MINNEAPOLIS, MINN.—JACKSONVILLE, FLA.

	Page	Miles
Minneapolis to	14	488.4
Chicago	20	971.6
Jacksonville		
Total Mileage		1460.0

MINNEAPOLIS, MINN.—BOSTON, MASS.

	Page	Miles
Minneapolis to	14	488.4
Chicago	46	609.0
Buffalo	43	307.6
Hudson	45	33.1
Pittsfield	32	40.9
Boston	35	190.6
Total Mileage		1669.6

MONTREAL, QUE.—CLEVELAND, O.

	Page	Miles
Montreal to	43	538.6
Buffalo	46	191.9
Cleveland		
Total Mileage		730.5

MONTREAL, QUE.—NEW HAVEN, CONN.

	Page	Miles
Montreal to	42	188.2
Lake George	45	182.1
Hudson	32	40.9
Pittsfield	36	159.1
Providence	29	124.3
New Haven		
Total Mileage		694.6

NEW HAVEN, CONN.—BUFFALO, N. Y.

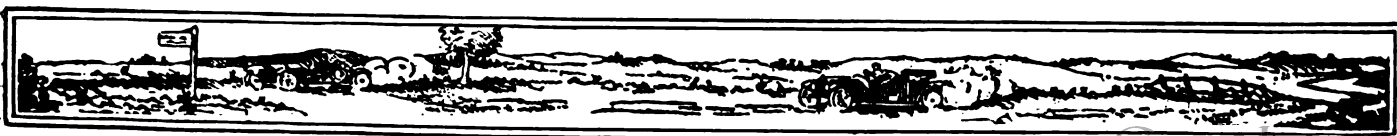
	Page	Miles
New Haven to	29	124.3
Providence	36	159.1
Pittsfield	32	40.9
Hudson	45	33.1
Albany	43	307.6
Buffalo		
Total Mileage		665.0

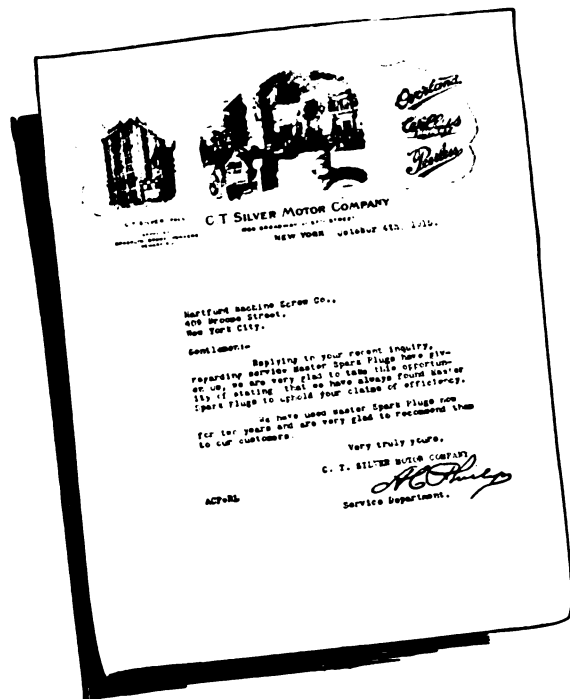
NEWPORT, R. I.—LAKE GEORGE, N. Y.

	Page	Miles
Newport to	34	18.5
Fall River	34	19.5
Providence	36	189.1
Pittsfield	32	40.9
Hudson	45	182.0
Lake George		
Total Mileage		450.1

NEWPORT, R. I.—BRETTON WOODS, N. H.

	Page	Miles
Newport to	34	18.5
Fall River		





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(When Writing to Advertisers, Please Mention The Automobile Journal.)

Directory of Touring Information

Providence	34	19.5
Boston	29	43.7
Bretton Woods.....	29	187.2

Total Mileage.....268.9

NEWPORT, R. I.-PHILADELPHIA, PENN.

Newport to	Page	Miles
Ferry to Narragansett Pier.....		
New York	28	160.7
Philadelphia	4	101.5

Total Mileage.....262.2

NEW YORK-CHICAGO-SAN DIEGO.

New York to	Page	Miles
Denver	4	2129.2
Phoenix	49	942.0
San Diego	22	438.1

Total Mileage.....3509.3

PHILADELPHIA, PENN.-BRETON WOODS, N. H.

Philadelphia to	Page	Miles
New York	4	101.5
Boston	28	245.7
Bretton Woods.....	29	187.2

Total Mileage.....584.4

PORTLAND, ORE.-PHOENIX, ARIZ.

Portland to	Page	Miles
Sacramento	48	716.7
San Francisco	5	136.2
Los Angeles	11	496.3
Phoenix	22	576.8

Total Mileage.....1926.0

PORTLAND, ORE.-SALT LAKE CITY, UTAH.

Portland to	Page	Miles
Sacramento	47	716.7
Salt Lake City.....	6	753.2

Total Mileage.....1469.9

PORTLAND, ME.-DETROIT, MICH.

Portland to	Page	Miles
Boston	28	146.2
Pittsfield	36	190.6
Hudson	32	40.9
Albany	45	33.1
Buffalo	43	305.6
Detroit	47	294.7

Total Mileage.....1011.1

PROVIDENCE, R. I.-GETTYSBURG, PENN.

Providence to	Page	Miles
New York	29	201.0
Gettysburg	4	300.3

Total Mileage.....501.3

PROVIDENCE, R. I.-PLATTSBURG, N. Y.

Providence to	Page	Miles
Pittsfield	36	159.1
Hudson	32	40.9
Lake George.....	45	182.1
Plattsburg	42	107.0

Total Mileage.....489.1

PROVIDENCE, R. I.-ATLANTIC CITY, N. J.

Providence to	Page	Miles
New York.....	29	201.0
Atlantic City.....	39	153.5

Total Mileage.....354.5

PROVIDENCE, R. I.-CHICAGO, ILL.

Providence to	Page	Miles
Pittsfield	36	159.1
Hudson	32	40.9
Albany	45	33.1
Buffalo	43	307.6
Chicago	46	580.0

Total Mileage.....1120.7

PROVIDENCE-ST. LOUIS, MO.

Providence to	Page	Miles
Pittsfield	36	159.1
Hudson	32	40.9
Albany	45	33.1
Buffalo	43	307.6
Chicago	46	580.0
St. Louis.....	45	333.8

Total Mileage.....1454.5

PROVIDENCE-ST. LOUIS, MO.

Providence to	Page	Miles
New York	29	201.0
St. Louis	9	1053.6

Total Mileage.....1254.6

SPRINGFIELD, MASS.-NARRAGANSETT PIER, R. I.

Springfield to	Page	Miles
Walpole	34	89.9
Narragansett Pier.....	29	54.9

Total Mileage.....144.8

SPRINGFIELD, MASS.-WASHINGTON, D. C.

Springfield to	Page	Miles
Walpole	34	89.9
New York.....	29	226.6
Washington	9	235.0

Total Mileage.....551.5

SPRINGFIELD, MASS.-RICHMOND, VA.

Springfield to	Page	Miles
Walpole	34	89.9
New York	29	226.6
Washington	9	235.0
Richmond	22	121.6

Total Mileage.....673.1

SPRINGFIELD, MASS.-BUFFALO, N. Y.

Springfield to	Page	Miles
Greenfield	37	36.9
Pittsfield	36	64.1
Hudson	32	40.9
Albany	45	33.1
Buffalo	43	307.6

Total Mileage.....482.6

SPRINGFIELD, MASS.-MONTREAL, QUE.

Springfield to	Page	Miles
Bretton Woods	37	250.5

Portland	29	197.2
Montreal	42	459.5

Total Mileage.....907.2

WATERBURY, CONN.-WASHINGTON, D. C.

Waterbury to	Page	Miles
New York	29	89.0
Washington	9	235.0

Total Mileage.....324.0

WATERBURY, CONN.-ATLANTIC CITY, N. J.

Waterbury to	Page	Miles
New York	29	89.0
Atlantic City	39	153.5

Total Mileage.....242.5

WATERBURY, CONN.-DETROIT, MICH.

Waterbury to	Page	Miles
Pittsfield	28	75.7
Hudson	32	40.9
Albany	45	33.1
Buffalo	43	307.6
Detroit	47	294.7

Total Mileage.....752.0

WASHINGTON, D. C.-CHICAGO, ILL.

Washington to	Page	Miles
Indianapolis	9	576.2
Chicago	20	196.9

Total Mileage.....773.1

WASHINGTON, D. C.-BRETON WOODS, N. H.

Washington to	Page	Miles
New York	9	235.0
Bretton Woods	29	395.6

Total Mileage.....630.6

WASHINGTON, D. C.-GREENPORT, L. I.

Washington to	Page	Miles
New York.....	9	235
Greenport	28	115

Total Mileage.....350

WASHINGTON, D. C.-PORTSMOUTH, N. H.

Washington to	Page	Miles
New York	9	235.0
Portsmouth	29	336.8

Total Mileage.....571.8

WORCESTER, MASS.-PHILADELPHIA, PENN.

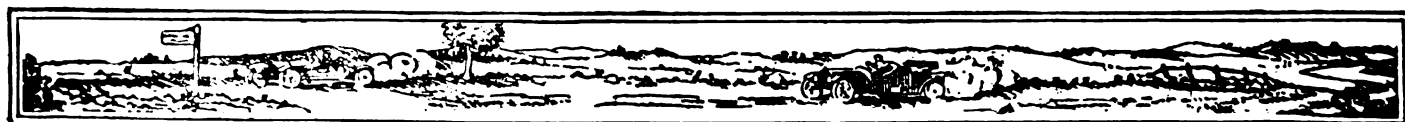
Worcester to	Page	Miles
New York	34	200.9
Philadelphia	9	95.6

Total Mileage.....296.5

WORCESTER, MASS.-COLORADO SPRINGS, COL.

Worcester to	Page	Miles
New York	34	200.9
Kansas City.....	9	1354.5
Colorado Springs.....	16	801.8

Total Mileage.....2357.2



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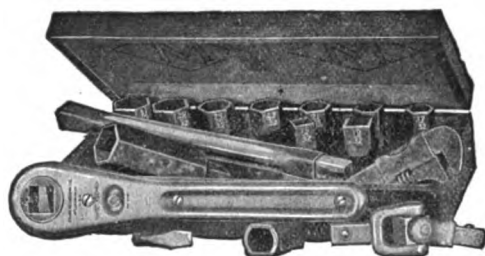
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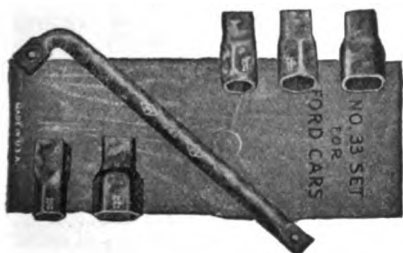
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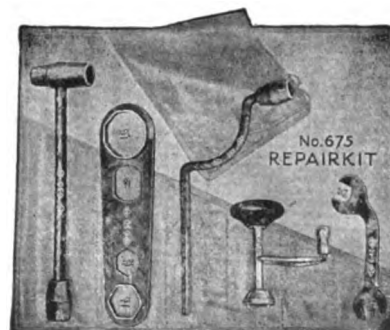
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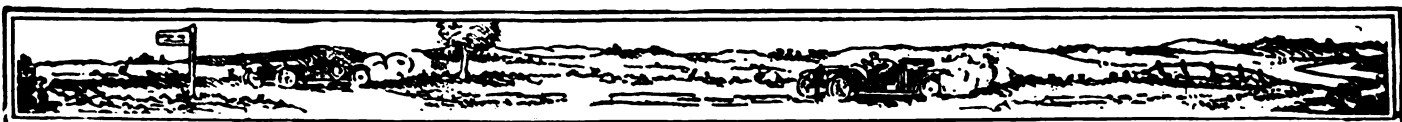
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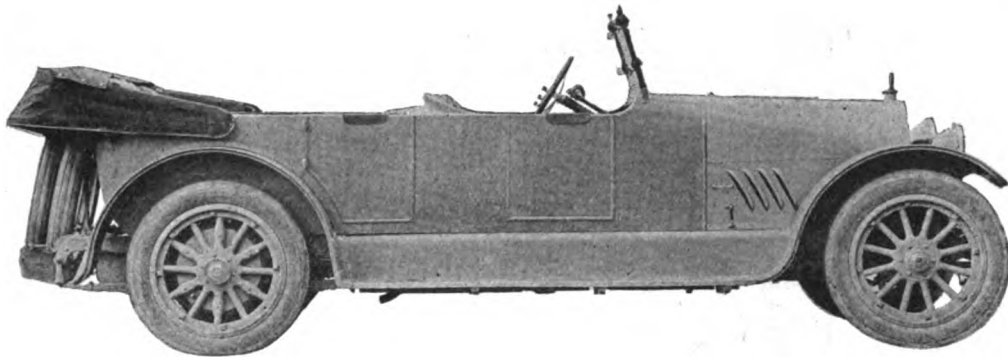
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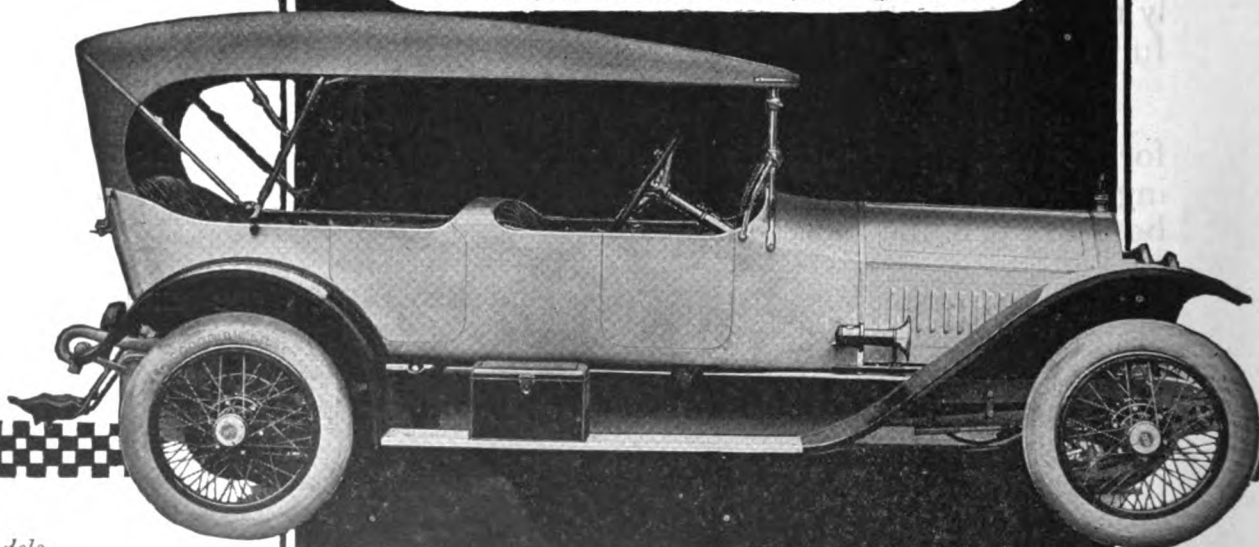


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STUTZ MOTOR CAR CO.
Indianapolis Indiana

(When Writing to Advertisers, Please Mention The Automobile Journal.)

GASOLINE IS GOING UP!!!!
Little Wonder
Vaporizing Valve
Cuts Your Gas Bill

37%
INCREASES POWER 34%

\$4.00 INVESTMENT

WHAT THE LITTLE WONDER VAPORIZING VALVE IS SHOWING IN EVERY DAY USE.

STUDEBAKERS gain 6 to 8 miles per gal. OVERLANDS gain 5 to 6 miles per gal. OLDSMOBILES gain 5 to 6 miles per gal.
 CADILLACS gain 4 to 5 miles per gal. HUDSONS gain 4 to 5 miles per gal. METZ gain 6 to 8 miles per gal. FORDS gain 6 to 8 miles per gal.

Tests by A. A. A. Proved These Savings AND INCREASED MOTOR POWER.

4-Cylinder Engine, 37 5/10% Gasoline Saved; 6-Cylinder, 41 8/10% gasoline saved; 8-Cylinder, 42 2/10% gasoline saved—
 Increase in power from 18% to 34%.

Over 300 in use by the U. S. Government, some in Mexico. If your dealer does not carry them, order direct.

Burgess Specialty Co., 98 Pond St., Providence, R. I.

WE HAVE THE PLUG



Regular $\frac{7}{8}$ " 18 S. A. E.
Long Type, Both Open End
and Closed End
Knight Type is Closed End

Standard S. A. E. $\frac{7}{8}$ "
Open End
Princess Automobile
Equipment



SPLITDORE COMMON SENSE SPARK PLUGS



Standard S. A. E.
 $\frac{7}{8}$ " Closed End
*Biddle, Kearns and
Monitor* Automobile
Equipment.



Franklin
Equipment



Heavy Hex Open End
 $\frac{1}{2}$ " and $\frac{7}{8}$ " Standard
Sizes



Buick Type
Up to 1915



$\frac{1}{2}$ " Open End
Long Special
Type for
Ford Cars



Standard $\frac{1}{2}$ "
Closed End

Overland and Pullman
Equipment is Open End Type



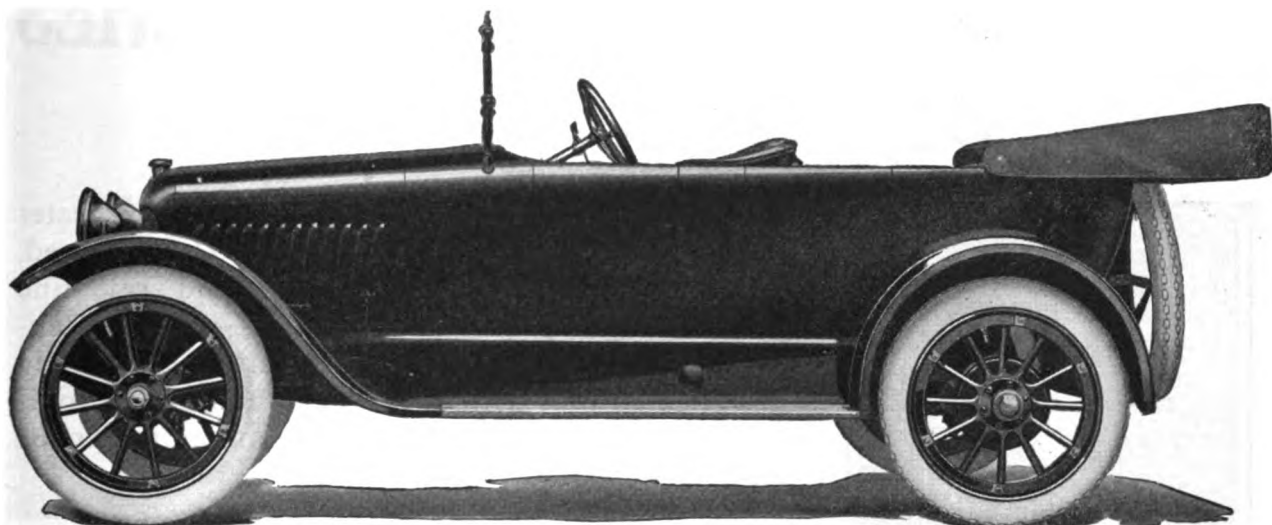
Metz Equipment



Automobile
Metric Type
Closed End
and
Open End

BEST SUITED FOR EVERY CAR

(When Writing to Advertisers, Please Mention The Automobile Journal.)



1917 **GRANT SIX** \$825

Everybody who has seen the 1917 Grant Six acclaims it as one of the best looking and best acting cars ever sold for less than a thousand dollars.

It *is* that because we made it that. Our conviction has always been that if we put the value *in* the car we wouldn't have to *prod* the buyers to make them see it there—and buyers *have* been quick to see it.

Back of the Grant Six is the organization with the longest experience in the building of a quality six to sell for less than a thousand dollars. Back of this organization is the necessary facilities and the necessary capital.

Do you see why the Grant Six is one of the fastest selling cars ever built? Do you see why Grant production has increased to 20,000 cars this season? There is nothing secret about it; the reason lies in the Grant Six with its wonderful Overhead Valve motor.

Five-passenger Touring Car or three-passenger Roadster, \$825

Three-passenger Cabriolet, \$1050

F. O. B. FACTORY

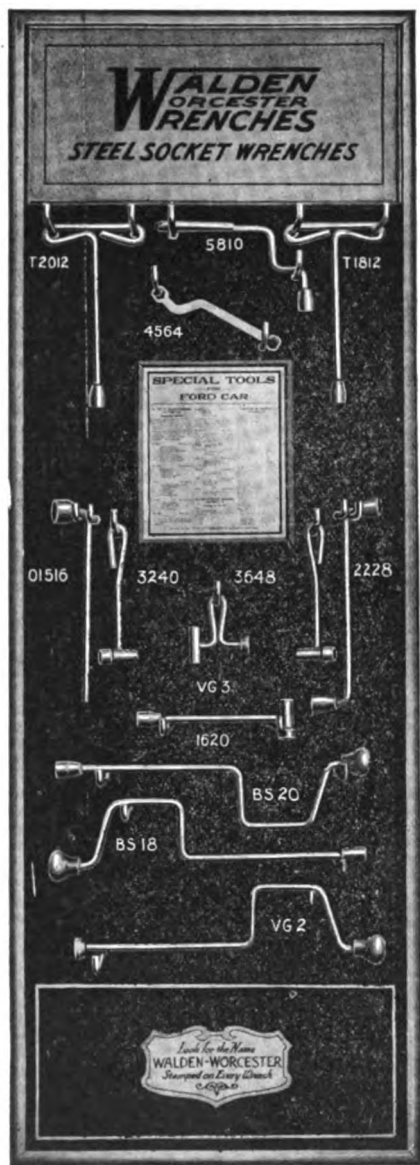
Let us send you the big four-color folder showing all the features of the 1917 Grant Six in detail.

GRANT MOTOR CAR CORPORATION

FINDLAY, OHIO

WALDEN-WORCESTER WRENCHES

FOR FORD CARS



NO. 78 SET
STOCK AND DISPLAY BOARD
SPECIAL WRENCHES FORD CAR
MAKE YOUR OWN CHOICE

Ask the dealer to show his display board of Walden-Worcester Wrenches for Ford cars. On it can be seen all standard and special tools for any work on these machines. In the center of the board is description of each tool and its special use.

Any combination that will best serve you, can be obtained from this board.

There's but one quality of Walden-Worcester Wrenches—the best material that can be obtained, the highest grade workmanship and scientific production methods insuring this—but Walden-Worcester Wrenches for Ford cars are specially designed so that with the fewest number of tools one can do any work—all bolts and nuts can be easily reached.

With a Walden-Worcester wrench set the initial cost is comparatively small, time and labor are economized, and the outfit can be conveniently carried because it is light weight and requires but small space. It's utility never lessens and is the same in the garage as on the road. The service life is practically unlimited.

All this is guaranteed to you when you buy Walden-Worcester wrenches. The Trade Mark will protect you.

For general automobile and shop work we specialize wrench sets—just as we have for Ford cars—and from our products we have made many combinations that are standard, but an owner who desires can select any special combination, being certain of quality and the guarantee. There's a Walden-Worcester tool for practically every purpose.

Let us send you a catalogue—it's yours for asking—and it will give you every information of single tools and combinations.

The Walden Manufacturing Co.

60 Commercial Street,

WORCESTER : : : MASSACHUSETTS

UNIVERSAL TRUCK ACCOUNTING SYSTEM

(Copyright, May, 1914, by The Automobile Journal Publishing Company.)
All Rights of Use or Publication in Any Form Reserved.

It affords every detail of time and work of any number of machines, the labor, operating cost, revenue and earnings, with comparisons for any period, in one record book and day cards for each truck.

The simplest and most comprehensive record ever conceived, adaptable for use with any method of house bookkeeping or independently, that can be made to serve as part of any method of accountancy.

The most intensely practical system of accounting ever devised, that can be maintained by a girl clerk and which has no limitations.

When you know the exact cost of truck operation and what is earned through the use of any vehicle, you have data of the greatest practical value.

Detailed information at request. When writing state number of trucks in use.

The Motor Truck

Times Building

Pawtucket, R. I.

Universal Truck Accounting System

(Copyright, May, 1914, by The Automobile Journal Publishing Company.)
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What it Is—

The only system that will give every record in one book.

But 14 pages are required for a full year's record for any one truck.

This record can be increased to include any number of machines in one book.

A day card for each truck, filled jointly by a clerk and the driver completes the system.

The driver has but a few entries to make on any job and any girl clerk can keep complete record for one or 100 trucks.

This system of a day card and record book will take the place of any number of record forms and give the information in greater detail.

This system is so remarkably complete and simple that any truck owner needs but an office day book in which to enter orders and a cash book and ledger.

This system can be utilized with any method of house bookkeeping without conflicting with it. Or it can be operated independently of any form of accounting.

What it Does—

Shows miles driven loaded and light.

Shows the time the trucks leave and return to the garage.

Shows driver's working time, hours in and out of garage.

Gives the owner an exact report of the work done.

Shows record of accidents, causes, place and names of witnesses.

Shows the owner the mechanical condition of the machines at all times.

Shows the daily mileage and the mileage for each job, and average speed per hour.

Shows driver's hours of work on any job.

Shows parts ordered, by whom, and the cost.

Shows record of undelivered goods and breakages.

Shows helpers' names and hours worked on any job.

Shows mechanical adjustments, repairs, inspection (when and by whom).

Shows average daily overhead expense, interest, taxes, insurance, and storage.

Shows when truck is withdrawn from service, time, cause and time of withdrawal.

Shows total cost of daily service, wages, supplies, repairs, overhead tires and tubes.

Shows repairs, work done by either driver or repairer, on the road or in the garage, what was repaired, time taken and the cost.

Shows revenue from truck service, depreciation, salvage, labor, work value, whether regular route, special trips, rented or job.

Shows tire record, giving accurate mileage for each tire, the cost of tire repair work, tube cost and repair, new tire cost, and tire adjustments made.

Shows driver's daily garage expense, cost of supplies, gasoline, current, oil, grease and miscellaneous items, whether supplied in the garage or on the road, and the cost.

Shows supplementary delivery form and record; when a number of items are to be delivered from any load, gives names and addresses for deliveries, the amounts to be collected or charged, time delivered, who received the goods delivered and the reasons for failure to deliver.

Shows office instructions to drivers, whether regular work or route, trip, rented or job; the time the truck started on work where to report, customer's name, address, time load was delivered, destination, whom delivered to and where delivered, time delivered, received by whom, time returned and total mileage, miles loaded and light, whether the driver was to collect for the work, whether the work was charged, the price, time delayed, the cause and driving time, the character of the load, whether bales, barrels, cases or bulk, the known or estimated weight.

What the System Will Tell the Owner at a Glance

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His total investment in the truck, the cost of operating it, and what the truck earns.

The exact cost of operating by item, any one truck against another, or in differing works.

Itemized statement of operating and overhead expense and truck revenue by days, weeks, months and annually, for comparison.

Cost of wages.

Cost of supplies.

Cost of accidents.

Mileage of every tire.

Days worked and days idle.

Mileage from gasoline and oil.

The work that is most profitable.

Cost of overhead or fixed charges.

The losses and the causes of losses.

Cost of repairs and the nature of repairs.

The efficiency of certain trucks for certain work.

The efficiency of drivers as measured by operating expense and revenue earned.

An average of operating and overhead expense and truck revenue for any given period, either days, weeks, months or annually, for comparison.

A total expense of operating and overhead for each month, the total for any number of months, and the average daily and monthly expense in comparison.

A trial balance for any period, showing the investment, the total expense of operating it, the revenue from operation, the depreciation earned, the market value of the machine, and the net loss or gain from ownership.

It checks waste in operating expense, in labor and mileage driven; it checks the driver and the garage; it checks fast driving, overloading and truck and tire abuse; it checks every garage expense and it checks the work done on the machine and its condition.

MICHELIN TIRES



MICHELIN
Universal Tread
Note the remarkable thickness of rubber and fabric

Low Price and High Quality

backed up by big advertising
give the Michelin dealer an
advantage over all competitors.

*Write for the
Michelin Proposition.*

Michelin Tire Company,

Milltown, N. J.

Compare these prices with those of other tires. Though unsurpassed in Quality at any price, Michelin Tires are almost as low-priced as the cheapest makes.

MICHELIN Universal Tread Casings and Red Tubes

Inch Sizes	Q.D. Straight Side	Q. D. Clincher	Red Inner Tubes
32x3 1/4	\$18.30	.....	\$3.55
32x4	24.90	\$24.90	4.65
33	25.65	25.65	4.25
34	25.95	25.95	5.00
36	27.95	27.95	5.30
34x4 1/4	33.00	33.00	6.55
35	34.75	34.75	5.90
36	35.70	35.70	6.90
37	36.60	36.60	6.30
35x5	40.50	40.50	6.55
37	41.90	41.90	8.35

Also made in soft bead clincher
size 31x4, price \$22.25



It's the same old COES

How often have you heard the repairman, machinist or shop manager say, "It's the same old Coes, just as good as the day I bought it—it will last forever."

That is evidence of the quality that has made Coes wrenches the standard the world over.

Coes Wrenches made today are just as good as the Coes Wrenches produced 50 years ago.

The material is selected with the same care, made by equally experienced and trained wrench makers, in a factory which specializes in wrench making. The wrenches are finished carefully and many times tested to assure the quality that will meet every requirement placed upon them.

Car owners who know wrench values demand the Coes. It is most popular with automobile repairmen, and in every other line of mechanical work Coes Wrenches will be found on the benches and in the tool kits of the expert workmen.

Coes wrenches can be had in just the size to fit any use. Any Coes will afford the same long and satisfactory service. It is always dependable and from the standpoint of wrench service it is the cheapest wrench produced.

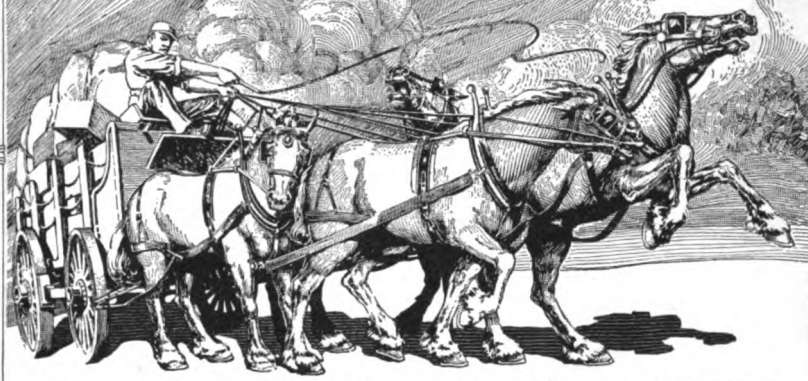
Coes wrenches are sold wherever motor cars are used. They may be had of all jobbers, automobile supply houses, and automobile and hardware dealers.

Catalogue on request.

Coes Wrench Company, Worcester, Mass.



(When Writing to Advertisers, Please Mention The Automobile Journal.)



FORD Owners: Have YOU?
This Kind of Power?

THIS is how your Ford acts with a poor ignition system. Each horse represents a cylinder of your engine, the wagon your car. Instead of pulling equally, as they should, one horse is jerking ahead, another to the side, one backing, and the other plunging in the air. The truck is getting nowhere. It is being wrenched and racked. It is a true example of **EXPENSIVE INEFFICIENCY**.

Poorly designed multi-unit coil ignition systems make your engine pull like these four balky horses; one cylinder pulls powerfully, another barely moves down on its proper stroke; each cylinder works against the others. There are vibration, uneven power and overheating. The engine and car soon become racked and ruined.

THE BOSCH MAGNETO
The Modern Ignition System

cures all this, for it serves the Ford as well as it serves the scores of high grade cars on which it is standard. It gives power and snap to the engine because its arc-like sparks ignite **ALL** the gas in the cylinders and occur in exact relation to each other. It produces even running, the utmost efficiency and a smile of satisfaction. It's like the powerful team pulling together—**IT'S A REAL NECESSITY**.

You save yourself all ignition worry, you get a better car, you're satisfied when you fit your Ford with a Bosch Magneto. A simple attachment makes it easy.

Write for "The Key to Ford Efficiency" and get an inkling how to make your Ford a better car.

Bosch Magneto Company, 204 West 46th Street, New York
Chicago Detroit Toronto San Francisco

Bosch Attachments made also for all battery ignited cars.

How Many Miles Per Gallon of Gasoline?



Motor Efficiency is Summed Up in the Answer

After all this talk about "high mechanical efficiency," "supreme motors," "splendid lubricating system," and "improved frictionless bearings," the car owner asks but one question—"How far can I go on a gallon of gasoline?" With gasoline approximately 30 cents per gallon, the question is naturally a vital one.

Little savings due to improved mechanism, seem petty compared with the amount of power that is actually contained in gasoline but wasted by incomplete combustion. You know that a certain amount of gasoline is passed through the motor unburned—yet you know that it **SHOULD** burn if freely mixed with air. Why not go right to the heart of the matter—why not supply, automatically, enough air to insure complete combustion with the

BRUGAN ECONOMY VALVE

\$4⁰⁰

Then you will get all the power in the fuel—that is, 15 to 35 per cent. more than ordinarily. You will get a more responsive engine and greater speed when you want it. You will use 20 to 40 per cent. less gasoline for a given mileage and you will almost entirely eliminate carbon from your cylinders. That's real, practical, dollar-and-cents efficiency that shows itself by gashing deeply into the monthly gasoline charge.

This little valve can be installed in any car in a few minutes by tapping into the intake manifold. Being **ADJUSTABLE**, it can be exactly suited to any car.

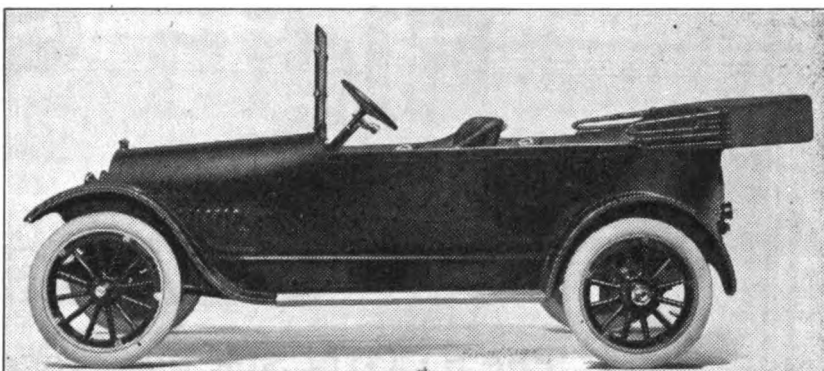
For sale at most good garages and dealers, or by mail, \$4.00.

The Brugan Company
Bangor, Maine

84-5



JACK
BILLARD
1914



"Laurel 35" Five Pass. Price \$795

***Four Cylinders
112-Inch Wheel Base***

***36-Horsepower
Weight 2100 Lbs.***

Built of the highest class steel throughout, with a faultless construction design, with unsurpassed easy riding qualities through its cantilever spring suspension, and with the outward appearance of a car double the price, it represents the greatest car value to be had in an automobile in the medium price class.

The wonderful power of the motor, considering the weight of the car, gives the "LAUREL 35" the most astonishing hill-climbing ability, and it easily outranks all other light-weight pleasure cars in this respect. At hill-climbing few cars at any price will excel her.

Equal in power to many large six-cylinder cars, weighing 1000 pounds more, it costs 1-3 to 1-2 less to operate, giving from 18 to 22 miles to the gallon of gasoline and double the tire mileage. There is not a weak spot in its construction and it has more high class mechanical and other features than can be had elsewhere at near the price.

Finished in one of the largest plants in Indiana, it represents every possible advantage in low material and factory production costs and the following Laurel features show it can only be compared with cars selling at hundreds of dollars higher price.

Light Delivery Bodies of every description furnished on Laurel 35 Chassis.

CONDENSED SPECIFICATIONS

High Speed Motor, three bearing crank shaft, bore 3 3/4", stroke 4 1/4"—36 Horse Power at 2800 revolutions—Unit Power Plant—Full Floating Axle—Cantilever Springs, main leaves Vanadium steel—Electric Starting and Lighting System—Dixie High Tension Magneto—Beautiful Streamline Body—Rear Seat 48" wide, full three passenger capacity—Wide Crown Fenders—Quick Attachable Curtains—One Man Top, full width—Goodyear Quick Demountable Rims—Goodyear 32x3 1/2 tires, non-skid on rear—Complete Equipment.

AGENTS AND BUYERS Send for our beautifully illustrated folder describing our line of pleasure and commercial cars and particulars how you can visit our factory at our expense. We have an exceptional agency contract and can make prompt deliveries. A Laurel agency is a sure success. Perfect satisfaction makes every buyer a traveling salesman for the agent. You will have Power, Construction, Appearance, Economy and Easy Riding Qualities combined at a price your competitor cannot meet.

Our folder tells you in detail the full story of the car. The high class steel used, bearings, axles and motor are all fully described. You will see why there is no after expense in free service to buyers as the superior construction of the car insures the greatest every day efficiency to the owner and therefore your discount will be a real profit on the Laurel which is not true of so many other cars. If there is no agent in your territory write us at once for our agency proposition.

Laurel Motor Car Company
Richmond, Indiana

(When Writing to Advertisers, Please Mention The Automobile Journal.)

Elgin Six

"CLASS"

The ELGIN SIX has grace and beauty of design that instantly appeals to the most exacting. The racy, yacht-line body and the full five-passenger roominess make it a car of character and distinction.

The mechanical construction throughout is of the highest standard—from the powerful 35 H.P. Six Cylinder valve-in-head motor, down to the smallest detail.

The ELGIN SIX performs like a thoroughbred under the most adverse conditions. It has abundant power and speed. It has perfect balance. Its riding qualities are unexcelled. Its average is twenty to twenty-five miles to the gallon of gasoline.



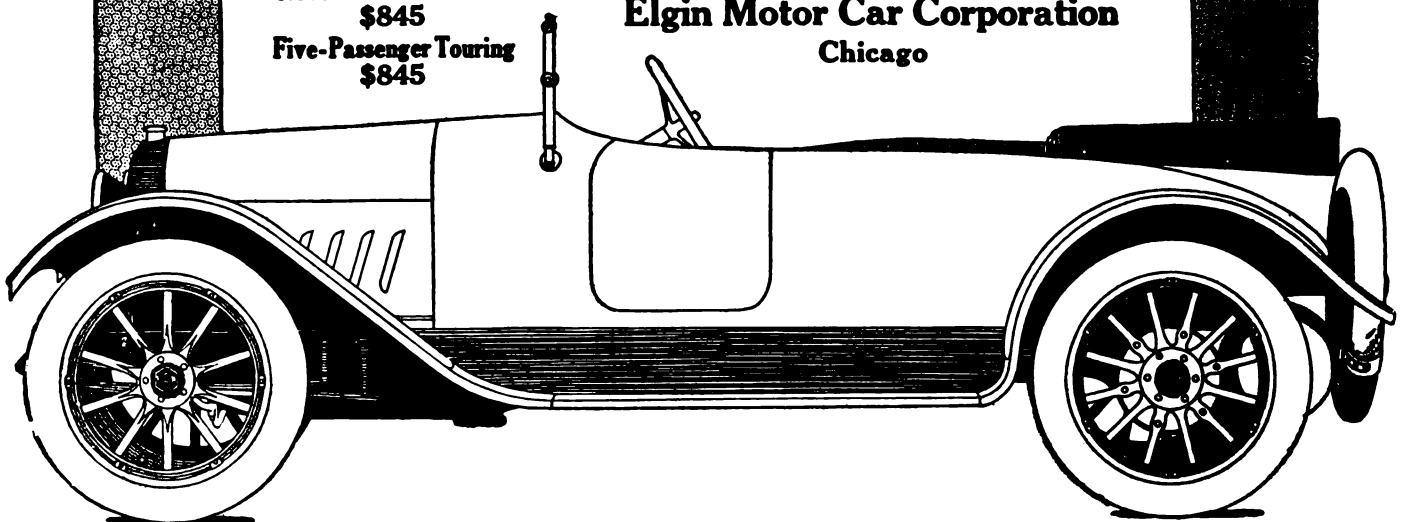
Dealers Will Appreciate These High-Grade Features

Six-Cylinder Valve-in-Head 35 H. P. Motor.	Multiple Disc, Dry Plate Clutch —Steel on Raybestos.
Unit Power Plant. Three-Point Suspension.	True Yacht-Line Body. Con- cealed Hinges and Door Locks.
V-Type Radiator. Thermo- Syphon Cooling.	Deep Upholstering on Resilient Springs.
Combination Force Feed and Splash Lubrication.	One Man Top—Jiffy Curtains.
Two-Unit Dyneto Electric Starting and Lighting System.	Heavy Stamped Crown Fenders.
Delco Ignition System.	Quick Detachable and De- mountable Rims.
Rayfield Carburetor. Stewart Vacuum Feed.	32" x 3 1/2" Black Tread Tires. Non-Skid Rear.
Three-Quarter Floating Rear Axle. 12 1/2" Brake Drum.	114" Wheel Base. Standard Tread. Clearance 10".
Springs, Semi-Elliptic Front, Self-Oiling Cantilever Rear.	Price \$845 f. o. b. Factory.

There is still some desirable territory open for responsible dealers. Write or wire us today.

Clover Leaf Roadster
\$845
Five-Passenger Touring
\$845

Elgin Motor Car Corporation
Chicago



(When Writing to Advertisers, Please Mention The Automobile Journal.)



Announcement 1917

There will be no change in the construction of Allen motor cars this year.

Model 37 has proven so highly satisfactory and is of such modern and correct design that it will fully meet the demands of any purchaser in its price-class.

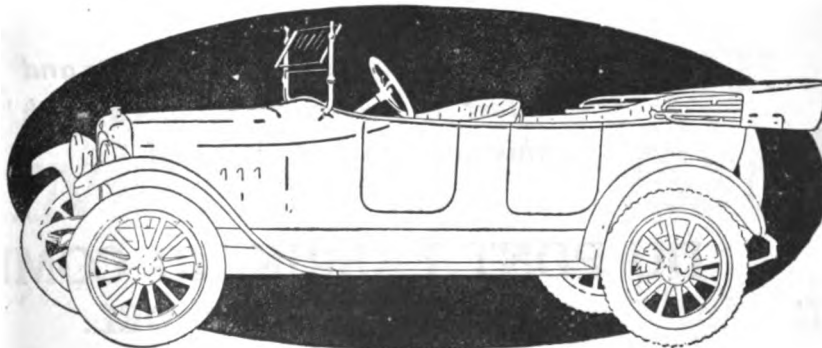
Through foresight in purchasing, increased factory facilities and the financial strength of the company, we are able to continue this model without increasing the price or reducing the quality.

Increased output enables us to take on a few more live dealers. Some good territory still open.

37 H. P. 4 Cyl. Motor	112-inch Wheelbase
3 3/4" Bore 5" Stroke	Full floating axle
Two Unit Electric Start- ing and Lighting System	55-inch Rear Springs
	Weight 2300 pounds

Roadster or Touring Car Same Price

The Allen Motor Company
407 Allen Bldg., Fostoria, Ohio



Is Your Car Top Heavy?

Why buy a light weight car burdened with a heavy top?

A low weight center means safer, easier riding. Unnecessary top weight means waste---increased vibration and side sway.

You pay for every additional pound with gasoline, oil, tires and general wear.

At the best the most efficient top material can only be a waterproof layer supported by cloth---the lighter the better---but strong enough to stand the strain when up, and flexible enough to fold without cracking.

Extra layers of cloth and combiners only add weight, diminish flexibility and increase the possibilities of cracking in folding. Mohair tops absorb pounds of water during a storm and accumulate dust when dry.



SINGLE TEXTURE TOP MATERIAL

is ideal for the modern one-man top. It is made of a single thickness of light, strong cloth coated with a flexible, waterproof compound that sheds water like a duck's back. It can be easily washed, always looks well and because it is chemically inert will not oxidize nor disintegrate. **Guaranteed one year** against leaking but built to last the life of your car. Any top maker can replace your old dusty or leaky top with Rayntite.



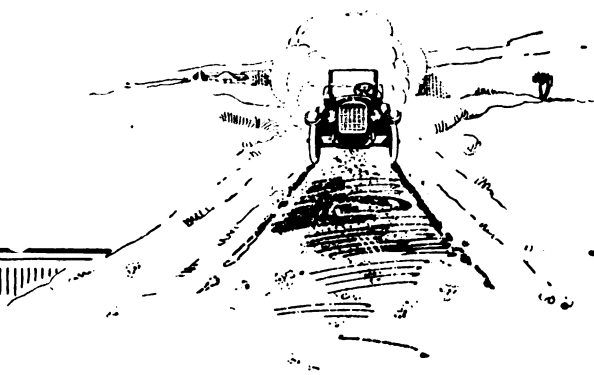
Du Pont Fabrikoid Rayntite will duplicate the remarkable success of Du Pont Fabrikoid Motor Quality---The Standardized Automobile Upholstery---used on 60% of 1916's entire output.

Write for samples and booklets and latest list of cars equipped with this modern top material.

**DU PONT FABRIKOID COMPANY
WILMINGTON, DEL.**

Works at Newburgh, N. Y.

Canadian Office and Factory, Toronto.



Coming!

The next issue of the Automobile Journal will carry the finest reproduction of a motor car yet made; an illustration in actual colors of the most attractively finished car under \$1000.

"Some car", to quote the lucky ones who have seen it.

A car that marks the beginning of a new epoch in motor car finish.

And better yet, this remarkably finished, moderate priced car is mechanically correct. It has proven itself to the satisfaction of thousands of owners.

***WATCH FOR IT
IN THE NEXT ISSUE***

(When Writing to Advertisers, Please Mention The Automobile Journal.)

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Motor Truck

Published Once a Month

*A Magazine for the
Motor Truck Owner*

**TIMES BUILDING
Pawtucket, R. I.**

Accessory and Garage Journal

A Distinct Trade Publication

25,000 Copies

Each Monthly Issue

**TIMES BUILDING
Pawtucket, R. I.**

EVERYTHING

For the Automobile—tires, horns, lamps, tool kits, magnetos, carburetors, etc.

AT CUT PRICES.

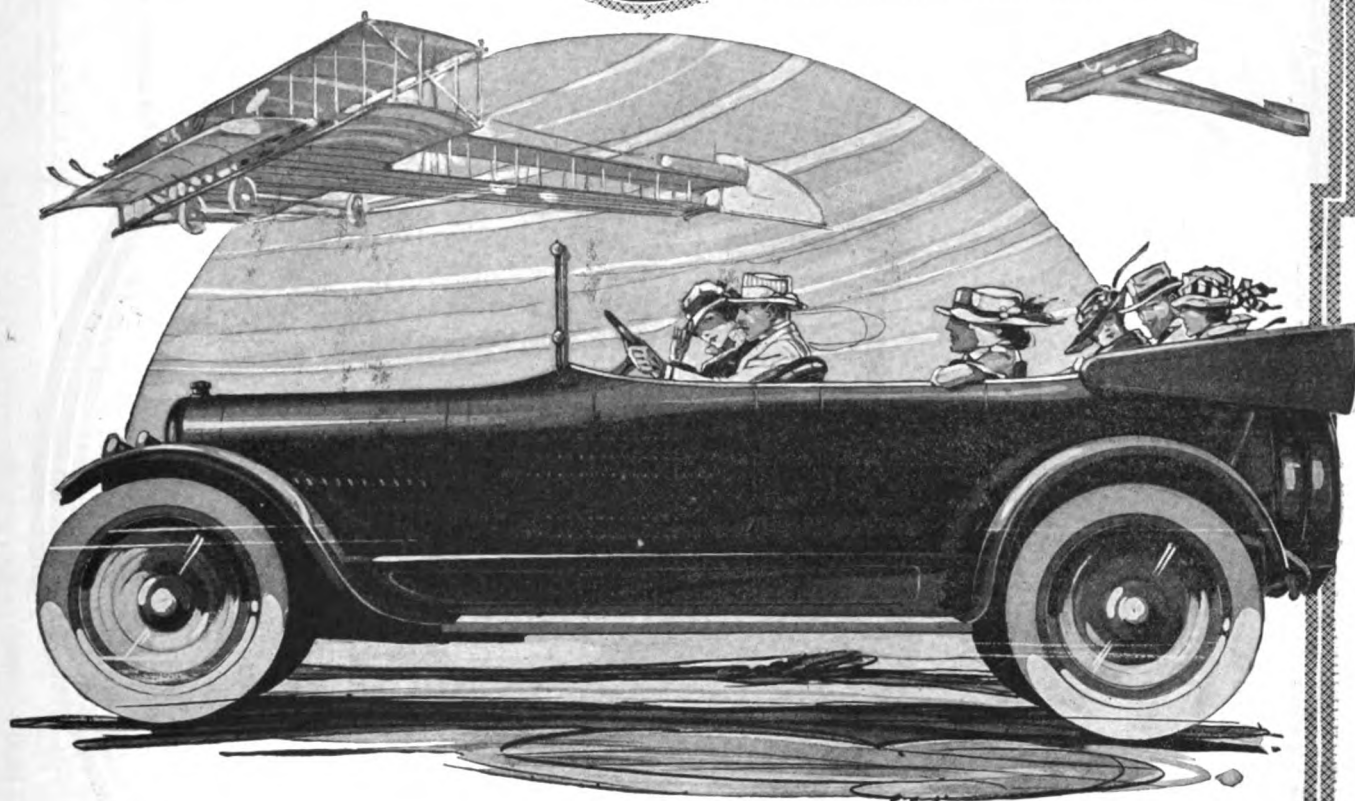
Our catalogue contains 3000 big bargains and represents the most complete stock of automobile supplies in the world.

Send for your copy of our **PRICE WRECKER Catalogue.**
TIMES SQUARE AUTOMOBILE COMPANY.

Largest Automobile Supply House in the World.
New York—58th St. and B'way.
Chicago—1210 Michigan Ave.

CHURCH ENGINEERING COMPANY

Industrial and Mechanical Engineers, 1223 Filbert Street, Philadelphia. Develop. Market and Finance Patents. Reorganize Industries.



And now comes—the ROADAPLANE!

The Apperson Roadaplane is the newest self-propelled sensation.

It is to road travel what the Aeroplane is to the sky and the Hydroplane to water.

It smooths out all roads, banishes for all time all mechanical troubles, and shatters to a hundred fragments all former motor-car limitations.

To ride in this marvel gives you the buoyancy of air support, and when at the wheel you unconsciously feel the satisfaction of being the master of seventy, mile-a-minute wings.

You get all the aeroplane thrills and sense of limitless freedom on **SAFE MOTHER EARTH.**

Man, during all his time on earth, has never experienced the riding sensations equal to the Roadaplane.

Here is an absolutely frictionless car—the Roadaplane fairly floats along the road—it is so free from all friction.

Here is a piece of mechanism so perfectly attuned

that you are unconscious of any mechanical effort whatever. It is in this important respect that the Roadaplane rivals air craft.

Here is a motor that challenges the most acute ear—it is so silent, so noiseless, so free from the slightest vibration—truly the work of mastermen.

Here is a car so exact in weight, so carefully balanced, that it is not a matter of mere pounds but **OUNCES.**

Here is a car so **MISERLY** in the use of gasoline that mileage records surpass all previous performances.

Here is a car so light on its feet that tire-life is prolonged to a time heretofore thought impossible.

The Apperson Roadaplane opens a new chapter in the history of motor travel. Find out what we have done by writing for "The Roadaplane Book," which gives complete details of these epoch-making cars.

The Roadaplane is made in six and eight-cylinder models. The seven-passenger touring and the famous four-passenger Chummy roadster bodies are mounted on either chassis.

If you are a live and energetic merchandising man and can see the value of this new name, backed by a national advertising campaign and representing extraordinary motor cars made by America's pioneer company, wire us today for our unusual dealers' proposition.

It will be a pleasure to send you photographs, complete catalogs, details of our advertising campaign—national, local and to the individual—and all details necessary for you to judge the value of the Apperson line for 1917.

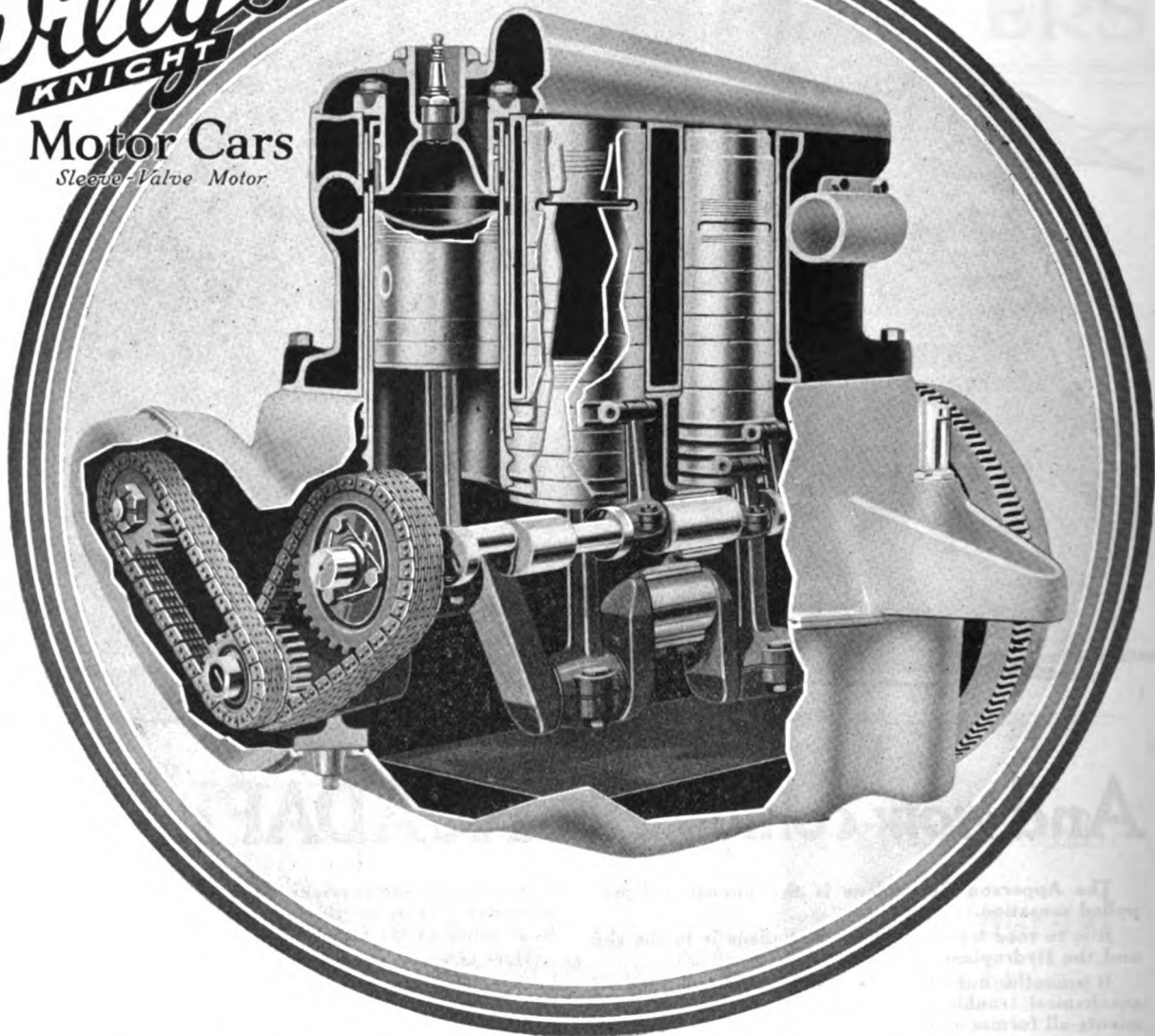
Apperson Brothers Automobile Co.

Kokomo, Ind.



(When Writing to Advertisers, Please Mention The Automobile Journal.)

Willys
KNIGHT
 Motor Cars
Sleeve-Valve Motor.



—its advantages are so well worth while

Here's what our experience with sleeve-valve motors on a big production scale has brought home to us.

At first it is the power and flexibility of these motors which win admiration.

For it is a fact that, size for size, cylinder for cylinder, the sleeve-valve motor delivers more power and has greater range on direct drive than any other type of motor.

That's one big positive sleeve-valve advantage

Next comes its improvement with use.

Men who have owned cars with the usual motor equipment have grown accustomed to the ills which come with age in ordinary motors.

They expect a certain perfection of performance in a new motor, but they expect to lay it up every once in a while to have the carbon cleaned out and the valves ground and reset.

Once a season they expect to give it up for overhauling and finally when no amount of doctoring will keep it quiet and bring back its power and pep, they expect to trade it in, take their depreciation, and get a new car.

So when a motor car veteran finds his sleeve-valve motor running quieter and with even greater power and pep as his mileage piles up his admiration is unbounded.

And that's another and a very great sleeve-valve advantage.

But the biggest advantage of all is durability.

Long after the time an ordinary motor would be completely worn out, you will find your sleeve-valve motor better than ever and you will hate to part with it.

So if you take delight in that common habit of a new car every year, perhaps you had better turn a deaf ear to sleeve-valve motor advantages.

But if you agree with us that greater power and flexibility, improvement with use, continuous, uninterrupted service and a great deal longer life are worth-while advantages—

Then remember that our huge production enables us to price sleeve-valve motored cars at hundreds of dollars less than they have ever before been priced, see the Overland dealer, and get a Willys-Knight.

The Willys-Overland Company, Toledo, Ohio

"Made in U. S. A."



EAGLEINE

What Others Say

EXPERIENCE with EAGLEINE AUTO OILS in practically all makes of cars in all parts of America and in every conceivable operating condition is reflected in our book of letters—letters written by motorists who know, and who have found in these lubricants the quality so essential for efficient, economical and positive engine operation.

These are letters from those who have knowledge of what is necessary for lubrication, who have driven from 10,000 to 20,000 miles without cleaning their engines, who have learned by use of different brands what has afforded them the best results, and—better still—these are unsolicited. They have been written after they have found what has fully satisfied them.

Send for this book of letters today. There could be no better guide for you to follow, and, if you like, you can communicate with them and verify every statement.

What We Say

EAGLEINE AUTO OILS will not smoot or soot. It carbonizes less than any other lubricants. That greater mileage can be obtained than with an equal volume of any other oil. It costs no more than other brands. It is sold in sealed containers to protect both dealer and consumer. It cuts upkeep and repair bills. Its use will add greatly to the service life of any engine. It is sold and guaranteed by all good dealers. That it is the **BEST OIL** that can be produced.

Send today for book of charts that will indicate just the quality-grade you should use in any engine. It is free at request.

EAGLE OIL AND SUPPLY COMPANY

44-45-46 India St.,
NEW YORK CITY
Woolworth Bldg.

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CHICAGO
1132 W. 37th St.

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NEW YORK

CHICAGO

CLEVELAND

BOSTON

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Foreign Countries in Postal Union, \$3.50 a year.

AUTOMOBILE JOURNAL

Remittances:

Should be made by Check, Draft, Postoffice or Express Money Order, or Registered Letter. Money enclosures must be at sender's risk.

Entered as second class matter, April 15, 1906, at the Postoffice at Pawtucket, R. I., under Act of Congress of March 3, 1879

Ten Cents
a Copy

VOL. XLI.

JULY 10, 1916.

NO. 11.

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Treasurer - - WILLIAM H. BLACK
Secretary - - - - D. O. BLACK, JR.

Published the 10th and 25th of each month by the

AUTOMOBILE JOURNAL PUB. CO.,
Times Building, Pawtucket, R. I.

FOR the Past 10 Years the Publisher of The Automobile Journal has made it a practice to gather into a single issue an exceedingly comprehensive amount of touring information for the benefit of the subscribers. With this issue is presented the Tenth Annual Touring Number, which comprises a very valuable compendium of touring data and is worthy of being retained throughout the year as a reference book. It is so arranged that the motorist can carry it in the car to guide himself on any journey in any part of the country, and has been thoroughly revised and brought up to date. The data covers the great transcontinental routes as well as the interstate and sectional roads.

EACH American Itinerary has been prepared with a view of connecting with the others presented, so that the tourist may start from any section of the country and visit by motor car any other locality. In the preceding pages will be found a directory of touring information by means of which the motorist can combine the itineraries which follow and thus map out a tour off the beaten track of travel. In addition there is a complete index to the more important vacation centres, night stops and principal cities.

TOO Much Emphasis cannot be laid upon the value of routing directions. In the itineraries is listed the forward and reverse mileages, by means of which the tourist may follow each tour in either direction. And it is possible as well not only to determine at all time the number of miles that have been covered at a given point, but the number of miles yet to be covered before reaching the night stop. In short, effort has been made to foresee every need and present a compilation of touring information that should prove to be of the utmost practicability.

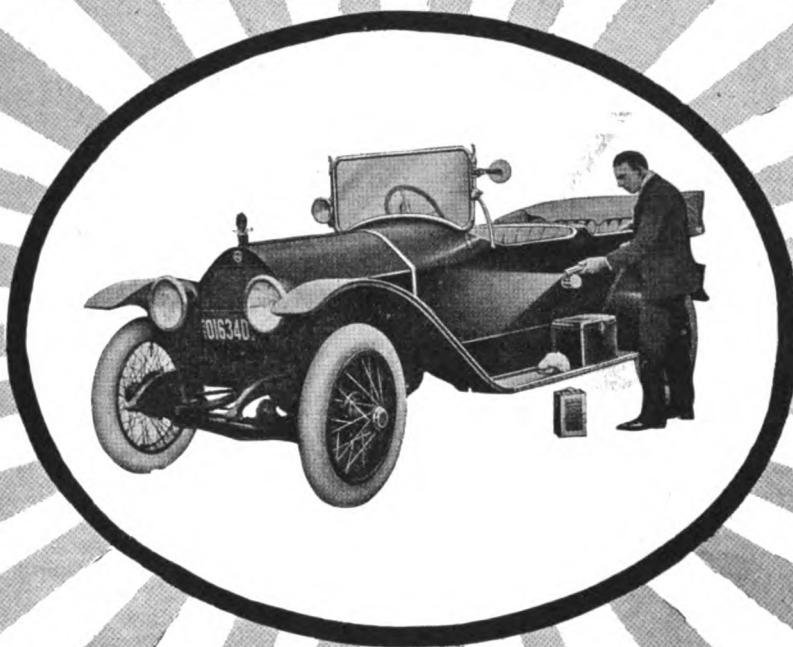
THE Regular Departments will be found to begin on page 52, these including a special and topical feature regarding fashion's dictates for the lady who drives or rides in a motor car. In the Equipment and Accessory Department the reader will find a selected group of devices that tend to make for economical and comfortable riding while en tour, several of the articles being peculiarly suited to the needs of the tourist. Do not neglect the advertising pages in this issue, for there also will be found the latest devices for motor cars, as well as cars themselves, and the standard supplies and accessories.

IN THIS issue Also, on page 13, appears an announcement of The Automobile Journal Publishing Company's Universal Truck Accounting System, which is the simplest and yet most comprehensive record ever conceived for the purpose, and one by which the purchaser can quickly obtain the return of his investment through the excellent service it renders. What the system is, what it does and what it tells the truck owner at a glance is graphically told in the announcement.

COLORADO'S Mountain Parks is the title of a Tib tour appearing in this issue. Therein are presented three of the justly celebrated Tib strip maps, which are features of the Tib touring books, published by the Touring Information Bureau of America. As is told in the Editor's note accompanying the story, this magazine is the official representative of the bureau, and because of that arrangement readers of The Automobile Journal are permitted to make use of the bureau's special service department without charge. The special service consists in part of special touring information which cannot be obtained elsewhere in published form.

WONDER-MIST

No Soap
No Water
No Labor



Keeps
Automobiles
Like New

Cleans - Polishes - Preserves

**Thousands of Motorists are Saving Money by Using
WONDER-MIST—The Original Polish with the Spray**

Every man who owns a car takes pride in its appearance. To keep it shining like new is as much to him as to keep it in good trim mechanically. That's why every car owner is a live prospect for Wonder-Mist sales.

WONDER-MIST not only cleans and polishes, but acts as a varnish food, conserving the fine finish of the car and adding to its life. It not only costs very much less, but it is actually more effective than any other method of caring for cars.

WONDER-MIST is applied with a sprayer, which is furnished free. It covers ten square feet with each spoonful of liquid and effects an extraordinary result. No water or soap are required and no rubbing is necessary.

WONDER-MIST is not an ordinary polish, but a combined dirt solvent and varnish renewer. It performs its function in the most effective manner and at the same time in the simplest and most logical fashion. Instead of adding and building up a waxy gloss over the dirt and dullness, it cleans right down to the surface and restores the elasticity of the varnish so that its original beauty is restored. It is guaranteed to be absolutely harmless and is equally effective for body, hood fenders, leather upholstery, windshield and all other exposed parts.

**One Gallon, \$3.00. Half Gallon, \$2.00.
One Quart, \$1.25**

Sprayer with each outfit.

DEALERS: The Market is Big and Growing with the Increase in Car Production. When You Hook Up with Wonder-Mist you Connect with a Permanent Source of Profit. We furnish Sales Helps, Window Displays, etc. Clip the coupon and Mail Now!

**THE
WONDER-MIST
COMPANY,
14 Federal Street,
Boston, Mass.**

THE WONDER-MIST COMPANY

General Office - 14 Federal St., Boston, Mass.

New York—1790 Broadway Chicago—162 N. Dearborn St.

Gentlemen:—Please send me full details of WONDER-MIST, selling terms and details of your Window Display Sales Help Campaign.

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Street.....

City.....

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Horseless Age, April 15,



CHANDLER SIX
\$1295

No "New Models" in Mid-Season

THE Chandler Type 17 was a perfected car January 1st. It had back of it three years of refinement, three years of making good. There is no reason to change it or modify it or call it by some new name in mid-season.

Chandler Values are Permanent

The Chandler Type 17—thousands of them on the road today from coast to coast and giving the most satisfactory service—is distinctively the medium priced car of the year.

It's the car of a perfected motor, and the most beautiful body design. It is the car of greatest all around value and no *marked up* price. There is ample excuse for an advance in price, but it would not add to the value to increase the price.

We could not give more in this great car just by asking you to pay more.

<i>Seven-Passenger Touring Car</i>	-	-	\$1295
<i>Four-Passenger Roadster</i>	-	-	\$1295

F. O. B. Cleveland

Write for New Catalogue and name of nearest Chandler Dealer

Chandler Motor Car Company

Cleveland, Ohio

New York Office, 1884 Broadway

Cable, "Chanmotor"

AUTOMOBILE JOURNAL

10th ANNUAL TOURING NUMBER

JULY 10, 1916

No. 10

VOL. XII

FROM the Atlantic to the Pacific ocean over the Lincoln Highway is probably the greatest and most popular long distance tour in the world. This transcontinental highway, over 3000 miles long, reaching from New York to San Francisco, has been mapped out less than three years and lays through the most beautiful sections of America. It is marked for most of its length with Lincoln highway road signs, which allows the tourist to follow it easily and for throughout most of the distance

OCEAN to OCEAN
on the LINCOLN HIGHWAY

the roads are in good condition. There is hardly a strip of 100 miles along the highway that does not pass through scenes of foremost historic interest in the eastern section of the country, while from the Mississippi westward the route is environed by nature's greatest wonders, towering mountains, abysmal canyons, precipitous water falls and forests that are unequalled throughout the world.

The start of the tour for the easterner begins in New York City. At Jersey City he comes upon the old Essex-Hudson plank road, which for over 100 years has been one of the main travelled thoroughfares of the state.

It has just recently been converted at large cost into a splendid boulevard, bordered by wide sidewalks and studded with electric lights. It has changed its name from the "Plank Road" to the "Lincoln Highway."

These New Jersey roads are about as perfect as any that are to be found in America. The route runs through a charming rural country, through the famous college town of Princeton to Trenton, the capital of New Jersey. The Delaware is crossed on a bridge not far from the point where Washington loaded his army in skiffs and took them across through ice jams during the revolution.

The river is followed to Philadelphia through a charming wood belt studded with many pretty villages until the city suburbs and factory districts are reached. From the city, which is itself of the greatest possible interest to the country in a historical way, the

route goes west, passing through Valley Forge, where Washington and his men starved and froze all one terrible winter. A classic chapel near Paoli has been built to commemorate the bravery of the men who suffered there.

Along the road beyond Valley Forge the men of many armies have marched. Every little way there are markers describing events stirring to the patriotic American. Along the Old Lancaster pike, long one of the finest roads on the continent, the tourist goes to the town of that name. It is the centre of one of the richest farming counties in America.

Then there is Columbia, touched in the Civil War by Lee's army in one of its northern drives. York, which is the Yorktown that gave its name to a revolutionary battle, and thence to Gettysburg, where Meade in the most gigantic struggle of the Civil War checked the advance of the South and won the first telling victory for the

Federals in the East. At Chambersburg an arch has been erected telling of the passage of Lee's army along the same road on their way to their great defeat. This was erected on the 150th anniversary of the founding and 50th of the burning of Chambersburg by the Confederates. Over excellent roads the route continues west through Bedford and Ligonier to Pittsburg.

Out of Pittsburg to the west the road goes through Beaver on the charmingly wooded banks of the Ohio river and on to East Liverpool. This section of Ohio is the centre of the pottery industry of the United States. Many large factories turn out earthenware of all types.

Crossing the Ohio river the motorist goes along a road that is receiving the direct attention of the state highways department and is surfaced most of the way with the brick paving which is coming to be standard pavement on the main roads of Ohio.

Another Ohio city on the route is Canton, where William McKinley lies under a monument of rare beauty and great impressiveness. Across Ohio the road goes in an almost straight line through Mansfield, Bucyrus, Upper Sandusky and Lima, and then the tourist enters Indiana, coming first to Fort Wayne.

Cities along this part of the highway are placing across the road arches and signs giving the distances to New York and San Francisco, and the names and population of their communities. Such a sign illuminated at night by electric lights has already been erected at Goshen, Ind., and one is planned for Fort Wayne in the near future.

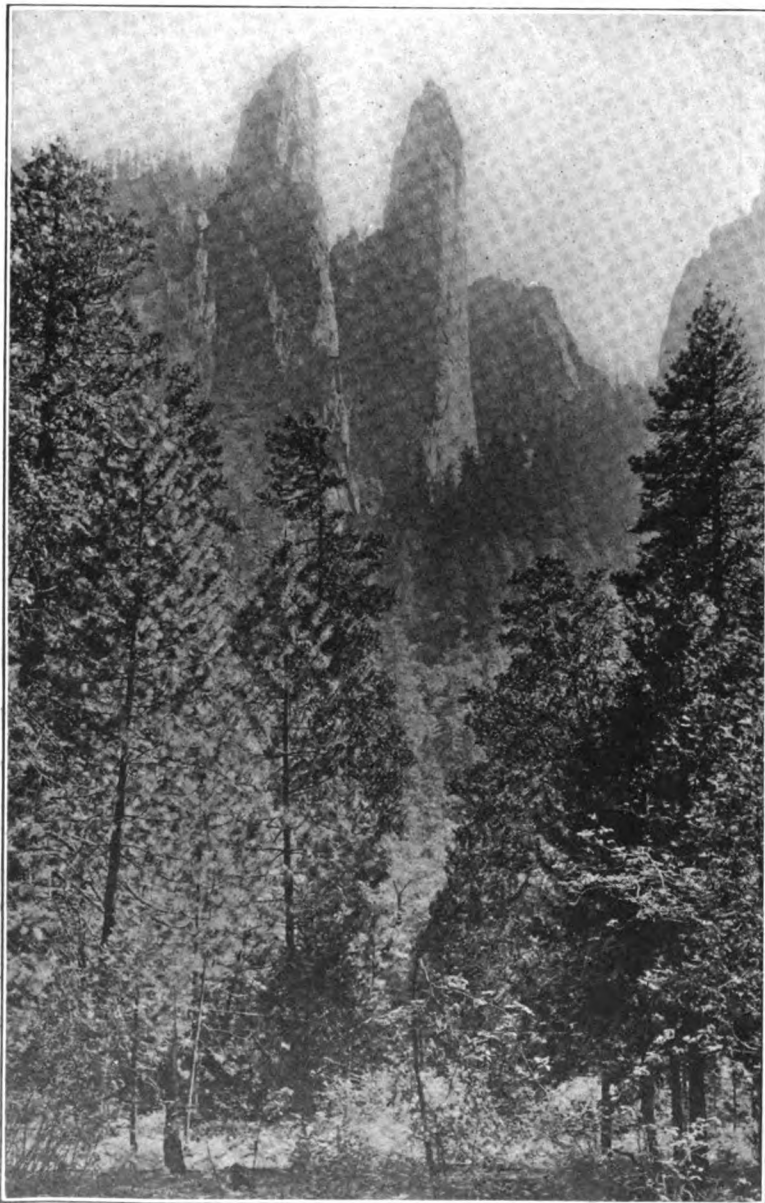
Elkhart, Ind., is a centre of enthusiastic sentiment for the Lincoln highway and the first section of the road to be constructed in the state according to the standard concrete specifications.

South Bend is located on the road at the point where tourists from Indianapolis and from all over Michigan strike it on their way to Chicago and is already a centre of a surprising large cross-country automobile traffic.

The next cities are La Porte and Valparaiso. The latter is the seat of Valparaiso university, which has more students than any other institution in the United States. It is a quiet and very attractive college town.

In entering Illinois the road passes 18 miles south of Chicago, which can be reached—and of course will be reached by the great majority of travellers—by a detour over very excellent roads.

Illinois roads are not quite up to the standard of some of the other states, but there is promise



Cathedral Spires, One of Nature's Masterpieces in California.

of much improvement in the immediate future. At Dixon, Ill., is a marker showing the point at which in 1856 Lincoln delivered his speech in one of the famous Lincoln-Douglas debates, which were part of his candidacy for the presidency of the United States.

Through Iowa the tourist sees one of the most prosperous farming sections in the United States. This great wheat and corn belt is full of farmers who own their own motor cars and who are enthusiastic advocates of good roads. The route lies through Clinton, Cedar Rapids, Marshalltown and Jefferson to Council Bluffs. All of these cities are prosperous centres of flourishing rural communities.

At Council Bluffs the Missouri river is crossed into Nebraska. At North Platte, the Platte river is crossed.

East of this point the best of accommodations have always been available, and from here on to the Pacific coast it is possible, if no accidents intervene, to make places at noon and at night where supplies and food may be had. Still it is better to be on the safe side by carrying food and water in the car and being prepared in case of emergency to camp in the open for the night. The furthest distance between towns or ranches which will accommodate strangers at any point in the road is 80 miles. The road is well marked throughout and is easy to follow.

In Nebraska the tourist comes upon the famous western dirt roads, which are maintained at a high state of perfection by dragging and rolling at regular intervals. Three-fourths of the length of the Lincoln highway in the State of Nebraska is treated regularly in that way.

The tourist goes straight west across the state through a splendid farming country most of the way to Big Springs and Cheyenne,



A Valley Road on the Truckee River, on the Boundary Line Between Nevada and California.

Wyo. The latter part of the distance to Cheyenne discloses some exceedingly picturesque scenery.

Cheyenne is a modern city, but not long ago it was one of those wild frontier places whose life and doings are of such consuming interest to the moving picture public. Yet every year one of the great events is Frontier Day, when cowboys and daring horsemen from every part of the West gather to demonstrate to an appreciative modern assembly the arts for which the West was famous in the days of the great cattle ranges. Here also is a great automobile speedway—the largest west of Indianapolis, where races are held every year.

From Cheyenne the tourist goes to Evanston, Wyo., and thence to Ogden, Utah, and Salt Lake City. Between these latter two towns the road is as good as the best in the East. This is now the land of the sage brush—the great American desert. Great Salt Lake, the American Dead sea, is

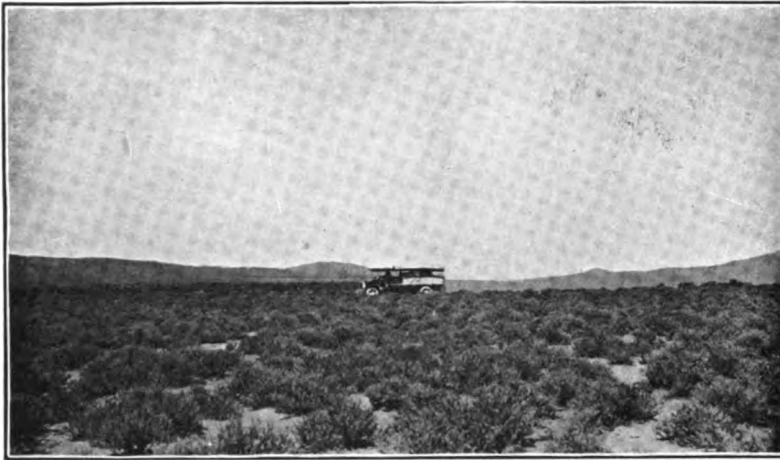
fading rapidly from the sands. On its shores is a wonderful city, where the Mormons have made the desert blossom like a rose.

The salt beds of Utah south of Great Salt Lake make a fine hard surfaced road, and one over which it is safe to make as high a speed as the car is capable of. The tourist enters the State of Nevada near Tippet's ranch. And from here three days of driving, stopping at night in ranch houses, lands the tourist at Reno, famous once for divorces and prize fights. Stations have been established all the way across the great desert, at which oil and gasoline are obtainable.

There are two routes from Reno to California. Through Carson City and along the shores of the beautiful Lake Tahoe, or further north by way of Truckee. California roads are already among the most famous in America and these perfected thoroughfares are being further perfected every year by the most aggressive and



On the Emigrant Gap Route Where It Passes Donner Lake, 7000 Feet Above the Sea.



Westward Bound Over the Sage Covered Desert in Utah.

effective of good roads movements.

In the Sierras the road reaches a height of 7000 feet above the sea level, with the brilliant blue of Donner lake sparkling below.

Turning south at Sacramento the tourist reaches Stockton, and after a short drive comes to Oakland, where the route ends. A short ferry ride from Oakland brings him to San Francisco.

ITINERARY. LINCOLN HIGHWAY.

Night Stops—New York City, Philadelphia, Gettysburg, Bedford and Pittsburg, Penn.; Canton and Lima, O.; South Bend, Ind.; Chicago, Ill.; Clinton and Marshalltown, Ia.; Omaha and Kearney, Neb.; Julesburg and Denver, Col.; Cheyenne, Rawlins and Green River, Wyo.; Salt Lake City and Kearney's Ranch, Utah; Ely, Austin and Reno, Nev.; Sacramento and San Francisco, Cal. Twenty-Four Days, 3174.7 Miles.

New York-Philadelphia, 101.5 Miles.

Ferry to Jersey City, N. J.

	Miles to	Total Miles
	Out	Return
Jersey City.....	0.0	0.0
Newark	10.1	10.1
West Elizabeth..	4.2	14.3
Elizabeth	2.0	16.3
Iselin	10.9	27.2
Metuchen	2.1	29.3
New Brunswick..	5.5	34.8
Franklin Park..	6.2	41.0
Kingston	6.8	47.8
Princeton	3.0	50.8
Lawrenceville..	5.1	55.9
Trenton	5.9	61.8
White Horse ..	4.1	65.9
Bordentown ..	3.1	69.0
Columbus	5.4	74.4
Burlington ..	7.5	81.9
Bridgeboro ..	5.2	87.1
Cinnaminson....	3.9	91.0
Camden	8.5	99.5
Philadelphia ..	2.0	101.5

Philadelphia-Gettysburg, 118.7 Miles.

	Miles to	Total Miles
	Out	Return
Philadelphia ..	0.0	0.0
Ardmore	9.4	9.4

Bryn Mawr.....	2.1	11.5	107.2
Wayne	3.9	15.4	103.3
Devon	1.5	16.9	101.8
Berwyn	1.4	18.3	100.4
Dalesford	1.2	19.5	99.2
Paoli	1.2	20.7	98.0
Malvern	1.5	22.2	96.5
Whitford	7.4	29.6	89.1
Downington ..	3.3	32.9	85.8
Coatesville ..	6.6	39.5	79.2
Ladsburyville..	3.9	43.4	75.3
Strasburg	10.2	53.6	65.1
Paradise	2.7	56.3	62.4
Lancaster	9.6	65.9	52.8
Columbia	10.2	76.1	42.6
Wrightsville ..	1.9	78.0	40.7
York	11.8	89.8	28.9
Thomasville ..	7.1	96.9	21.8
Abbotstown ..	7.7	104.6	14.1
New Oxford ..	4.2	108.8	9.9
Gettysburg ..	9.9	118.7	0.0

Gettysburg-Bedford, 80.1 Miles.

	Miles to	Total Miles
	Out	Return
Gettysburg	0.0	0.0
Seven Stars ..	3.9	3.9
McKnightstown..	1.9	5.8
Cashtown	1.9	7.7
Fayetteville ..	11.4	19.1
Chambersburg ..	5.5	24.6
St. Thomas	7.4	32.0
Fort London ..	6.0	38.0
McConnellsburg..	8.1	46.1
Harrisonville ..	6.4	52.5
Breeswood	11.4	63.9
Everett	8.4	72.3
Mt. Dallas	1.1	73.4
Bedford	6.7	80.1

Bedford-Pittsburg, 100 Miles.

	Miles to	Total Miles
	Out	Return
Bedford	0.0	0.0
Wolfsburg	2.5	2.5

Schellsburg	6.9	9.4	96.6
Buckstown	13.5	22.9	77.1
Stoyestown	2.0	24.9	75.1
Jenners	10.7	35.6	64.4
Jennerstown ..	1.0	36.6	63.4
Laughlinstown..	8.8	45.4	54.6
Ligonier	3.0	48.4	51.6
Youngstown ..	9.1	57.5	42.5
Greensburg	10.0	67.5	32.5
Grapeville	4.1	71.6	28.4
Adamsburg	2.3	73.9	26.1
Irwin	3.0	76.9	23.1
Jacksonville ..	1.2	78.1	21.9
Circleville	0.6	78.7	21.3
E. McKeesport..	5.8	84.5	15.5
Wilmerding	1.5	86.0	14.0
Wilkinsburg ..	6.7	92.7	7.3
Pittsburg	7.3	100.0	0.0

Pittsburg-Canton, 97.9 Miles.

	Miles to	Total Miles
	Out	Return
Pittsburg	0.0	0.0
Sewickley	13.5	13.5
Ambridge	4.2	17.7
Economy	1.0	18.7
Freedom	7.0	25.7
Rochester	2.0	27.7
New Brighton..	3.0	30.7
Beaver Falls ..	1.5	32.2
Darlington	8.2	40.4
Unity, O.....	8.7	49.1
Columbiana	7.6	56.7
Washingtonville.	4.2	60.9
Salem	5.1	66.0
Damascus	5.5	71.5
Alliance	8.1	79.6
Harrisburg	6.8	86.4
Louisville	4.5	90.9
Canton	7.0	97.9

Canton-Lima, 153.5 Miles.

	Miles to	Total Miles
	Out	Return
Canton	0.0	0.0
Massillon	8.0	8.0
Brookfield	2.3	10.3
Greenville	3.0	13.3
Dalton	3.9	17.2
East Union	6.3	23.5
Wooster	6.6	30.1
Jefferson	4.4	34.5
Reedsburg	4.5	39.0
Jeromeville	4.7	43.7
Hayesville	4.5	48.2
Mifflin	5.5	53.7
Mansfield	8.3	62.0
Ontario	6.6	68.6
Gallion	8.4	77.0
Bucyrus	11.0	88.0
Onecola	6.5	94.5
Upper Sandusky	10.0	104.5
Forest	14.0	118.5
Patterson	1.8	120.3
Dunkirk	6.0	126.3
Ada	10.3	136.6
Lima	16.9	153.5

Lima-South Bend, 144.3 Miles.

	Miles to	Total Miles
	Out	Return
Lima	0.0	0.0



One of the Frequent Mountain Bridges Encountered in the Far West.

Elida	6.5	6.5	137.8
Delphos	9.3	15.8	128.5
Van Wert	13.3	29.1	115.2
Convoy	6.7	35.8	106.5
New Haven, Ind	21.2	57.0	87.3
Fort Wayne	6.4	63.4	80.9
Churubusco	14.5	77.9	66.4
Noblesville	7.3	85.2	59.1
Wolf Lake	4.5	89.7	54.6
Kimmell	5.0	94.7	49.6
Ligonier	5.5	100.2	44.1
Millersburg	9.2	109.4	34.9
Goshen	9.4	118.8	25.5
Dunlap	4.7	123.5	20.8
Elkhart	5.5	129.0	15.3
Osceola	6.0	135.0	9.3
Mishawaka	5.3	140.3	4.0
South Bend	4.0	144.3	0.0

South Bend-Chicago, 101.1 Miles.

		Total Miles	
		Miles to	Out Return
South Bend	0.0	0.0	101.1
New Carlisle	13.6	13.6	87.5
La Porte	12.3	25.9	75.2
Pinhook	8.4	34.3	66.8
Westville	2.7	37.0	64.1
Valparaiso	10.3	47.3	53.8
Wheeler	7.5	54.8	46.3
Hobart	5.2	60.0	41.1
Gary	4.0	64.0	37.1
Highlands	7.4	71.4	29.7
Hessville	2.2	73.6	27.5
Gibson	1.1	74.7	26.4
Grasselli	1.0	75.7	25.4
Calumet	0.9	76.6	24.5
East Chicago	1.1	77.7	23.4
Whiting	3.0	80.7	20.4
South Chicago	5.3	86.0	15.1
Bryn Mawr	3.0	89.0	12.1
Chicago	12.1	101.1	0.0

Chicago-Clinton, 147.5 Miles.

		Total Miles	
		Miles to	Out Return
Chicago	0.0	0.0	147.5
Austin	7.9	7.9	139.6
Oak Park	3.4	11.3	136.2
Maywood	0.8	12.1	135.4
Elmhurst	5.3	17.4	130.1
Lombard	4.1	21.5	126.0
West Chicago	9.1	30.6	116.9
Geneva	5.5	36.1	111.4
Elburn	8.4	44.5	103.0
De Kalb	15.8	60.3	97.2
Creston	11.2	71.5	76.0
Rochelle	6.1	77.6	69.9
Ashton	12.0	89.6	57.9
Franklin Groves	4.6	94.2	53.3
Dixon	9.7	103.9	43.6
Sterling	14.4	118.3	29.3
Emerson	3.6	121.9	25.6
Morrison	10.7	132.6	14.9
Union Grove	3.7	136.3	11.3
Fulton	7.6	143.9	3.6
Lyon, Ia.	1.3	145.2	2.3
Clinton	2.3	147.5	0.0

Clinton-Marshalltown, 167.4 Miles.

		Total Miles	
		Miles to	Out Return
Clinton	0.0	0.0	167.4
Elvira	9.5	9.5	157.9
De Witt	11.6	21.1	146.3
Grand Mount	5.7	26.8	140.6
Wheatland	10.3	37.1	130.3
Lowden	6.2	43.3	124.1
Clarence	8.5	51.8	115.6
Mechanicville	10.8	62.6	104.8
Lisbon	7.0	69.6	97.8
Mt. Vernon	1.8	71.4	96.0
Marion	13.2	84.6	82.8
Cedar Rapids	5.8	90.4	77.0
Belle Plaines	34.5	124.9	40.5
Chelsea	6.5	131.4	34.0
Tama	11.5	142.9	22.5
Montour	8.5	151.4	14.0
Marshalltown	14.0	167.4	0.0

Marshalltown-O m a h a, 219.3 Miles.

		Total Miles	
		Miles to	Out Return
Marshalltown	0.0	0.0	219.3
State Center	14.5	14.5	204.8
Celo	8.8	23.3	196.0

Nevada	7.3	30.6	188.7
Ames	8.1	38.7	180.6
Jordan	10.6	49.3	170.0
Boone	5.6	54.9	164.4
Ogden	10.3	65.2	154.1
Beaver	6.4	71.6	147.7
Grand Junction	4.6	76.2	143.1
Jefferson	7.9	84.1	135.2
Scranton	10.0	94.1	125.2
Ralston	6.7	100.8	118.5
Glidden	5.0	105.8	113.5
Carroll	7.5	113.3	106.0
West Side	12.6	125.9	93.4
Vall	5.9	131.8	87.5
Denison	9.1	140.9	78.4
Arlon	8.5	149.4	69.9
Dow City	2.5	151.9	67.4
Dunlap	8.6	160.5	58.8
Woodbine	11.6	172.1	47.2
Logan	10.1	182.2	37.1
Missouri Valley	9.7	191.9	27.4
Loveland	4.7	196.6	22.7
Crecent	10.4	207.0	12.3
Council Bluffs	7.9	214.9	4.4
Omaha, Neb.	4.4	219.3	0.0

Omaha-Kearney, 196.5 Miles.

		Total Miles	
		Miles to	Out Return
Omaha	0.0	0.0	196.5
Elkhorn	17.1	17.1	179.4
Waterloo	3.2	20.3	176.2
Fremont	17.2	37.5	159.0
Ames	8.3	45.8	150.7
North Bend	8.2	54.0	142.5
Rogers	7.2	61.2	135.3

Roscoe	6.1	151.6	44.9
Ogallala	7.3	158.9	37.6
Brule	11.0	169.9	26.6
Julesburg, Col.	26.6	196.5	0.0

*Julesburg-Denver, 204.9 Miles.

		Total Miles	
		Miles to	Out Return
Julesburg	0.0	0.0	204.9
Ovid	8.3	8.3	196.6
Sedgwick	8.2	16.5	188.4
Red Lion	10.5	27.0	177.9
Crook	6.9	33.9	171.0
Proctor	8.3	42.2	162.7
Iliff	7.4	49.6	155.3
Sterling	12.3	61.9	143.0
Atwood	6.5	68.4	136.5
Merino	6.0	74.4	130.5
Hillrose	19.2	93.6	111.3
Brush	9.7	103.3	101.6
Fort Morgan	9.5	112.8	92.1
Morville	35.5	148.3	56.6
Bennett	24.8	173.1	31.8
Watkins	9.5	182.6	22.3
Sable	12.3	194.9	10.0
Denver	10.0	204.9	0.0

Denver-Cheyenne, 100.2 Miles.

		Total Miles	
		Miles to	Out Return
Denver	0.0	0.0	100.2
Broomfield	16.5	16.5	83.7
Lafayette	6.0	22.5	77.7
Berthoud	11.9	34.4	65.8



Ancient Stone Roadside Dwelling in Utah.

Schuyler	8.2	69.4	127.1
Benton	8.9	78.3	118.2
Columbus	7.6	85.9	110.6
Duncan	8.7	94.6	101.9
Silver Creek	8.3	102.9	93.6
Ravens	5.7	108.6	87.9
Clarks	5.5	114.1	82.4
Central City	12.9	127.0	69.5
Chapman	5.8	132.8	63.7
Grand Island	17.3	150.1	46.4
Alda	8.0	158.1	38.4
Wood River	10.0	168.1	28.4
Shelton	8.5	176.6	19.9
Gibbon	6.2	182.8	13.7
Buda	8.5	191.3	5.2
Kearney	5.2	196.5	0.0

Kearney-Julesburg, 196.5 Miles.

		Total Miles	
		Miles to	Out Return
Kearney	0.0	0.0	196.5
Odesa	9.6	9.6	186.9
Elm Creek	7.0	16.6	179.9
Overton	9.9	26.5	170.0
Lexington	10.3	36.8	159.7
Cozad	18.3	55.1	141.4
Willow Island	5.1	60.2	136.3
Gothenburg	7.8	68.0	128.5
Brady Island	13.3	81.3	115.2
Maxwell	9.4	90.7	105.8
North Platte	15.6	106.3	90.2
Hershy	13.6	119.9	76.6
Sutherland	6.6	126.5	70.0
Paxton	12.2	138.7	57.8
Korty	6.8	145.5	51.0

Loveland	7.3	41.7	58.5
Fort Collins	13.0	54.7	45.5
Wellington	11.7	66.4	33.8
Cheyenne, Wyo.	33.8	100.2	0.0

Cheyenne-Rawlins, 195.5 Miles.

		Total Miles	
		Miles to	Out Return
Cheyenne	0.0	0.0	195.5
Borle	9.5	9.5	186.0
Otto	5.0	14.5	181.0
Granite Canyon	4.7	19.2	176.3
Ruford	8.1	27.3	168.2
Laramie	31.3	58.6	136.9
Medicine Bow	74.0	132.6	62.9
Carbon	9.4	142.0	53.5
Hanna	13.0	155.0	40.5
Fort Steele	25.6	180.6	14.9
Greenville	7.9	188.5	7.0
Rawlins	7.0	195.5	0.0

Rawlins-Green River, 157.5 Miles.

		Total Miles	
		Miles to	Out Return
Rawlins	0.0	0.0	157.5
Latham	30.0	30.0	127.5
Wamsutter	10.0	40.0	117.5
Red Desert	8.5	48.5	109.0
Tipton	8.0	56.5	101.0
Monell	12.0	68.5	89.0
Bitter Creek	25.0	93.5	64.0
Black Buttes	10.0	103.5	54.0
Mallville	6.0	109.5	48.0
Point of Rocks	6.0	115.5	42.0

Rock Springs.....	26.0	141.5	16.0
Green River.....	16.0	157.5	0.0

**Green River-Salt Lake City,
190.1 Miles.**

	Total Miles	
	Miles to	Out Return
Green River.....	0.0	190.1
Bryan.....	13.7	176.4
Granger.....	20.9	155.5
Limman.....	29.1	126.4
Fort Bridger.....	5.7	120.7
Dog Springs.....	10.4	110.3
Spring Valley.....	7.1	103.2
Evannston.....	18.7	84.5
Wabatch, Utah.....	10.2	74.3
Castle Rock.....	7.1	67.2
Emery.....	7.9	59.3
Coalville.....	14.6	44.7
Wanship.....	13.2	31.5
Gorgosa.....	9.1	22.4
Dale.....	10.3	12.1
Salt Lake City.....	12.1	0.0

**Salt Lake City-Kearney's
Ranch, 145 Miles.**

	Total Miles	
	Miles to	Out Return
Salt Lake City.....	0.0	145.0
Garfield.....	19.0	126.0
Grantsville.....	9.0	117.0
Temple.....	7.0	110.0
Josepa.....	16.0	100.0
Palmer's.....	9.0	91.0
Pauls.....	6.0	85.0
Bullionville.....	45.0	40.0
Fish Spring.....	20.0	20.0
Kearney's Ranch.....	20.0	0.0

**Kearney's Ranch-Ely, 125
Miles.**

	Total Miles	
	Miles to	Out Return
Kearney's Ranch.....	0.0	125.0
Ibapah.....	36.5	88.5
Tippett, Nev.....	15.0	73.5
Shelbourne.....	18.5	55.0
Kent.....	30.0	25.0
McGill.....	12.3	12.7
Ely.....	12.7	0.0

Ely-Austin, 147 Miles.

	Total Miles	
	Miles to	Out Return
Ely.....	0.0	147.0
Lane City.....	2.5	144.5
Rilepetown.....	8.0	136.5
Kimberly.....	1.0	135.5
Moorman's.....	21.0	114.5

Rosevear's.....	2.5	35.0	112.0
White Pine.....	6.0	41.0	106.0
Pancake.....	14.0	55.0	92.0
Eureka.....	22.0	77.0	70.0
Austin.....	70.0	147.0	0.0

Austin-Reno, 183.5 Miles.

	Total Miles	
	Miles to	Out Return
Austin.....	0.0	183.5
Alpine Ranch.....	47.5	136.0
Eastgate.....	12.5	123.5
Westgate.....	20.0	103.5
Sand Springs.....	10.0	93.5
Fallon.....	27.0	66.5
Leetville.....	8.0	58.5
Hasen.....	8.5	50.0
Fernley.....	12.5	37.5
Wadsworth.....	3.5	34.0
Sparks.....	30.0	4.0
Reno.....	4.0	0.0

†Reno-Sacramento, 152.7 Miles.

	Total Miles	
	Miles to	Out Return
Reno.....	0.0	152.7
Lawton.....	6.5	146.2
Verdi.....	5.5	140.7
Truckee, Cal.....	23.0	117.7
Emigrant Gap.....	32.0	85.7
Alta.....	12.0	73.7
Gold Run.....	4.0	69.7
Magra.....	3.5	66.2
Colfax.....	7.5	58.7
Welmar.....	5.2	53.5
Clipper Gap.....	6.7	46.8
Auburn.....	6.0	40.8
Folsom.....	19.0	21.8
Sacramento.....	21.8	0.0

**Sacramento-San Francisco,
136.2 Miles.**

	Total Miles	
	Miles to	Out Return
Sacramento.....	0.0	136.2
Elk Grove.....	14.8	121.4
McConnell.....	3.1	118.3
Arno.....	2.2	116.1
Galt.....	6.2	109.9
Woodbridge.....	7.3	102.6
Lodi.....	3.0	99.6
Stockton.....	15.8	83.8

French Camp.....	5.0	57.4	78.8
Banta.....	11.9	69.3	66.9
Janney.....	7.0	76.3	59.9
Alta Mont.....	11.6	97.9	48.3
Greenville.....	2.7	90.6	45.6
Livermore.....	4.6	95.2	41.0
Dublin.....	10.3	105.5	30.7
East Oakland.....	22.1	127.6	8.6
Oakland.....	3.1	130.7	5.5
San Francisco.....	5.5	136.2	0.0

***Alternative.**

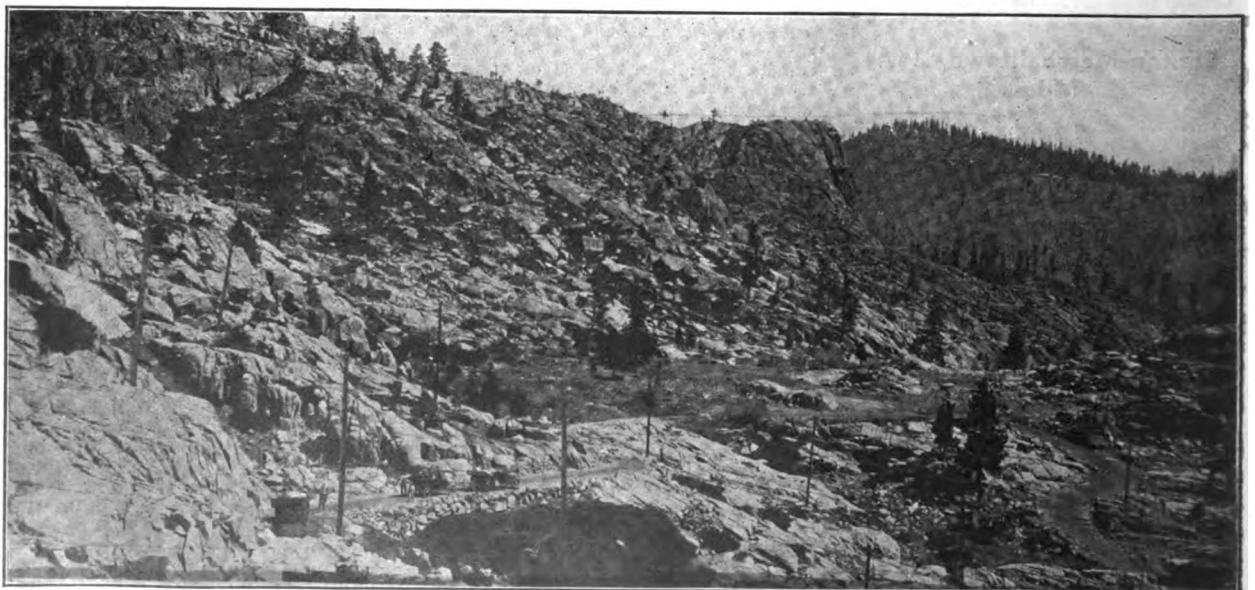
**Julesburg-Cheyenne, 145.2
Miles.**

	Total Miles	
	Miles to	Out Return
Julesburg.....	0.0	145.2
Chapell, Neb.....	15.0	130.2
Lodgepole.....	9.5	120.7
Sunol.....	14.0	106.7
Sidney.....	4.5	102.2
Brownson.....	8.0	94.2
Herdon.....	5.5	88.7
Potter.....	5.5	83.2
Jacinto.....	4.5	78.7
Dix.....	4.5	74.2
Owasco.....	4.5	69.7
Kimball.....	5.0	64.7
Oliver.....	6.7	58.0
Bushnell.....	5.5	52.5
Pine Bluff, Wyo.....	10.0	42.5
Egbert.....	10.5	32.0
Burns.....	10.0	22.0
Archer.....	14.0	8.0
Cheyenne.....	8.0	0.0

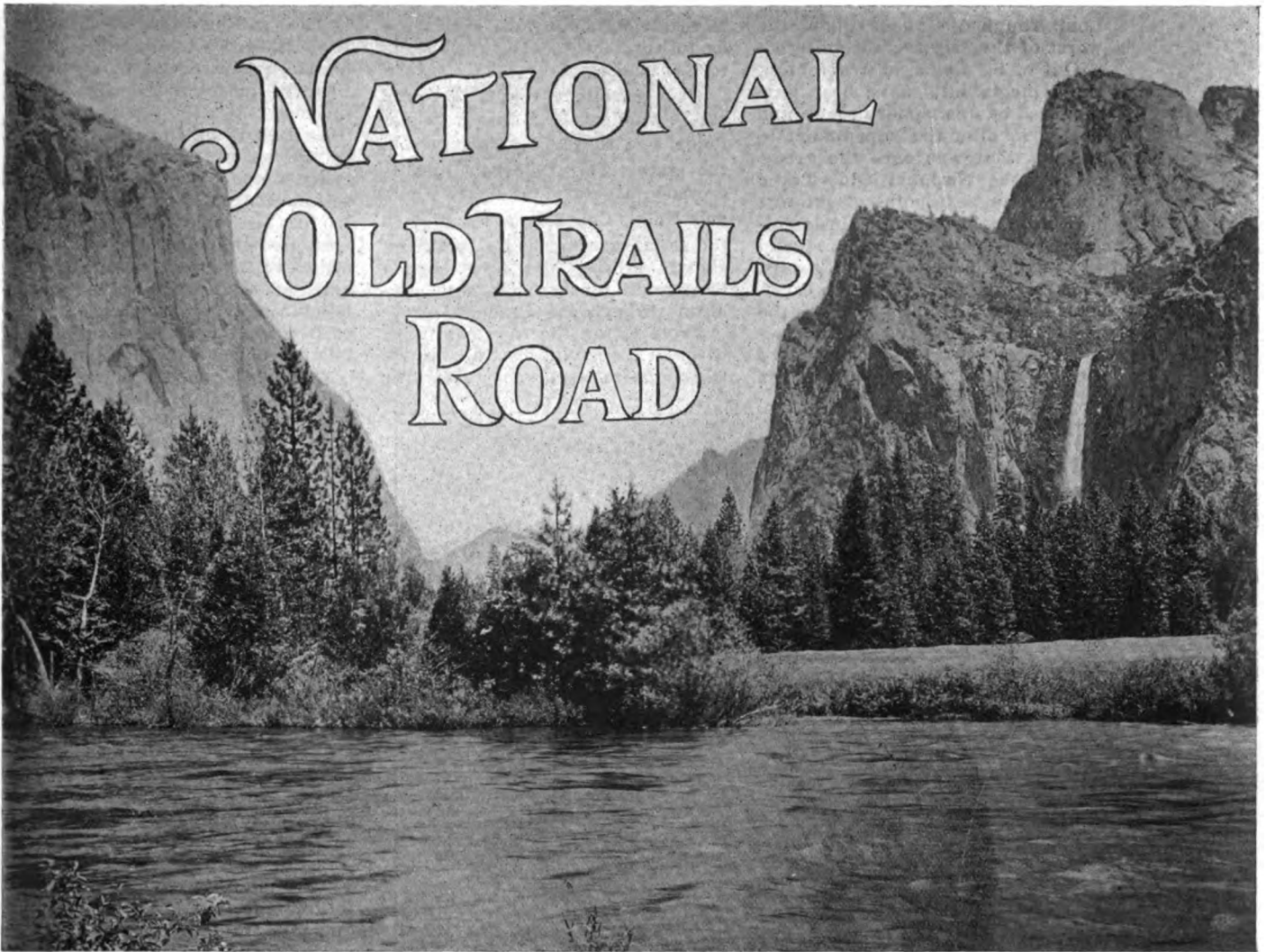
†Alternative.

Reno-Sacramento, 165.9 Miles.

	Total Miles	
	Miles to	Out Return
Reno.....	0.0	165.9
Steamboat Springs.....	11.5	154.4
Carson City.....	20.5	133.9
Edgewood.....	26.0	107.9
Meyers, Cal.....	9.7	98.2
Phillips.....	3.5	94.7
Echo.....	7.2	87.5
Kyburn.....	10.0	77.5
Riverton.....	10.0	67.5
Pacific.....	4.5	63.0
Camino.....	8.0	55.0
Placerville.....	7.0	48.0
Eldora.....	7.5	40.5
Shingle Spring.....	5.0	35.5
Clarksville.....	8.0	27.5
White Rock.....	2.0	25.5
Mills.....	13.5	12.0
Perkins.....	6.0	6.0
Sacramento.....	6.0	0.0



The Easterner's First Contact with the Rocky Mountains on the Lincoln Highway.



Southwestern Coast to Coast Tour.

ANOTHER coast to coast route, which is mapped out from New York City through the southwest and then north along the Pacific Coast to San Francisco, is known as the National Old Trails Road. This tour is more popular in the late fall and winter, the route passing south of the Lincoln Highway through St. Louis, Kansas City, across New Mexico, Arizona and Southern California.

The route starts from New York City and proceeds from the ferry landing at Weehawken southwestward to Camden, and thence across the Delaware river to Philadelphia. Here there are hundreds of points of interest, too well known and too numerous to mention. They include Independence hall, the Betsy Ross house, League Island navy yard, Fairmount park and the University of Pennsylvania.

The next leg of the trip runs from Philadelphia to Wilmington, through Havre de Grace to Baltimore, with its many points of great interest, and thence to Washington. Among the legion of things to be seen at the nation's capital are the Capitol,

White house, Arlington National cemetery, the Botanical gardens, Corcoran Art galleries, Bureau of Fisheries, the Lincoln museum, Smithsonian institute and Zoological park.

Turning slightly toward the north and continuing westward, the road goes through Fredrick, Hagerstown, Hancock to Cumberland, Maryland. Here it takes up the course of the first of the "Old Trails," from which it has taken its name. This is the Old National pike, built by the federal government early in the 19th century.

The tourist follows "The Narrows," as the gorge cut by the Potomac river is called, up through the hills, with striking mountain views constantly before his eyes.

The highest point reached in crossing the Alleghenies is at Keyser ridge, where an elevation of 2800 feet is reached. Near Strawn, Penn., the Pennsylvania state line is crossed to Sommerfield on the Youghiogheny river.

Northwestward, at Farmington, is the site of Fort Necessity, where Washington suffered defeat at the hands of the French

and Indians, and thence goes the road through several villages to Uniontown, where there are many coal mines. Out to the northwest from Uniontown the road leads to Brownsville, where the Monongahela river is crossed. Washington, Penn., is passed and the West Virginia state line is encountered at West Alexander. The next stop is Wheeling, the capital of the state. Here the Ohio river is crossed into Ohio. There is now an unbroken stretch of brick paving 16 feet wide through Zanesville to Columbus.

From Columbus to the Indiana state line, on the old National road, there is much brick paving and before long every mile of it will be surfaced with brick. The route lies through Springfield, Dayton, Eaton and Richmond to Indianapolis. From Indianapolis the road runs slightly south of west to Terre Haute, famous for its distilleries and the centre of a rich agricultural and coal mining district. West of Terre Haute, Marshall, Ill., the end of the actually constructed section of the old National road, is quickly reached, and from there on to St.



Louis rough dirt roads, about the worst of the trip are encountered.

Out of St. Louis, at Warrenton, the Mineola hills have been surmounted by fine modern roads and no longer offer the impediment to tourists that was once the greatest on the National Old Trails road. The next point of interest is Fulton, Mo., seat of three colleges, a school for the deaf and the state hospital. Westward from Fulton the roads are excellent and the country one of the most prosperous and well developed agricultural sections of the United States. The route taken

Through Marshall, Mo., a thriving agricultural centre, the road leads to Kansas City.

Over excellent roads, through the wonderful Kansas wheat fields, the route goes west across the state. The Colorado line is crossed between Coolidge, Kan., and Holly, Col. The route crosses the Arkansas river at La Junta and shortly crosses the New Mexico line to Raton, to which it goes down through the Raton pass.

From Raton the road continues through a thriving cattle country, where there are many gates for

The southwestern terminus of the Sante Fe trail is the city of Sante Fe, Mexican in its spirit and history and wonderfully rich in interest.

La Bajada hill, out of Sante Fe to the westward, is a climb that every motorist will remember, not so much from its difficulty, as from the fine views obtainable from its summit, and the evidence of great labor expended to provide "good roads." Albuquerque is extremely interesting because of its Indian and Mexican life—a fine type of the Mexican city.

Acoma is perched on a precipitous rock 300 feet above the face of the plain and 7000 feet above the sea level. The only entrance to the town was formerly a staircase, cut in the face of the rock. All the dirt used in building, as well as that which covers the graveyard, was once carried up the steps on the backs of the inhabitants. It took 40 years to carry up the graveyard.

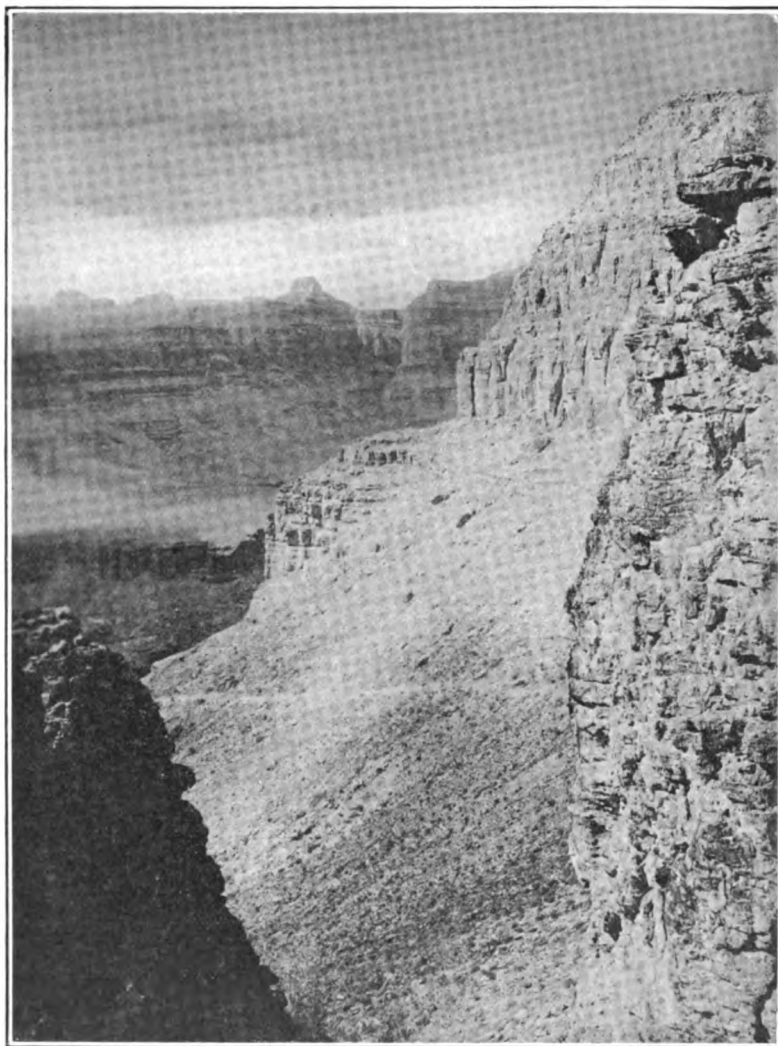
Near Guam, N. M., the tourist comes into view of Pyramid rock and Navajo church. At Fort Wingate the Mexican soldiers, who entered the United States by crossing the Rio Grande during the Carranza revolution against Huerta, were quartered. They have done much labor on the roads thereabout and have greatly improved them.

Through this country the road follows the fourth and last of the ancient trails from which the route takes its name, the Old Padres trail, over which the priests travelled in their efforts to carry the gospel to the Indians.

Flagstaff, Arizona, 7000 feet high, is in the centre of a great national forest reserve, the largest pine forest remaining in the United States. It is at the foot of the San Francisco peaks. From Flagstaff a side trip of 69 miles each way over a good road leads to the Grand Canon of the Colorado.

Crossing the Colorado river, at Topcock, on the Sante Fe railroad bridge, which has been planked to allow the passage of motor cars, the tourist arrives shortly at Needles, Cal., which is on the eastern side of the great Mojave desert. Needles is the northern terminus of boat traffic down the river to the Gulf of California.

Across the Mojave desert, once a great graveyard for travellers and their animals, a fine modern road, costing \$10,000 to \$15,000 a mile has been built. It is kept oiled most of the way and alkali dust is scarce on the run of 165 miles, which can be made at better than 20 miles an hour by almost any car. There are stations, too, where car supplies and food may be purchased. From Barstow, on the western side of the desert, it is a run of 78 miles to



Lower Section of the Hermit Trail in the Grand Canyon, Reached by a Detour from the National Old Trails Road.

through this part of Missouri is that of the Boone Lick trail, which took its name from Daniel Boone, the famous frontiersman. At Rocheport the road touches the Missouri river, which is later crossed on a ferry from Old Franklin to Booneville.

At Booneville the third of the old trails, the Sante Fe, begins and continues through Kansas City, across Kansas and a corner of Colorado, through New Mexico to Santa Fe.

West from Booneville to Arrow Rock are very fine dirt roads.

the motorist to open and close so that cattle may not escape their ranges. Even at its lowest point the road here is a mile above sea level. The air is extremely dry and decay is so slow that the signs of an ancient civilization are visible in many places. Wagon Mound takes its name from a hill which has the shape of a prairie schooner. It is the first real Mexican town encountered by the westbound traveller. Las Vegas also has an interesting Mexican quarter in old Las Vegas, across the Gallinas river.

San Bernardino. El Camino Real, from San Diego to the north, connected the old Spanish missions, rare specimens of a distinctive architecture, with each other. Los Angeles is 68 miles from San Bernardino and from there are the best roads to San Francisco, and all other points in the state.

The California state road along the coast from Los Angeles to San Francisco is as good as any road to be found in the United States. On test runs automobiles have covered the distance at more than 40 miles per hour, beating the fastest express trains on the railroad. It goes through some of the finest cultivated districts of California and every foot of it is exceptionally interesting.

ITINERARY.

NATIONAL OLD TRAILS ROAD.

Night Stops—New York City, Philadelphia, Washington, D. C.; Cumberland, Md.; Wheeling, W. Va.; Columbus, O.; Indianapolis, Terre Haute, Ind.; St. Louis, Columbus, Mo.; Kansas City, Emporia, Hutchinson, Dodge City, Syracuse, Kan.; La Junta, Trinidad, Col.; Las Vegas, Santa Fe, Albuquerque, McCarty's, Gallup, N. M.; Holbrook, Flagstaff, Kingman, Ariz.; Amboy, San Bernardino, Los Angeles, Santa Barbara, Pasa Robles, Santa Cruz, San Francisco, Cal. Thirty-one Days, 3726 Miles.

New York-Philadelphia, 95.6 Miles.

	Miles to	Total Miles
	Out Return	
New York	0.0	95.6
Weehauken Ferry	1.6	94.0
Weehauken	1.6	94.0
Jersey City	4.7	89.3
Newark	5.9	83.4
Elizabeth	5.8	77.6
Rahway	5.1	72.5
Iselin Station	4.3	68.2
Metuchen	4.0	64.2
New Brunswick	4.6	59.6
Monmouth Jct.	10.8	48.8
Trenton	16.6	32.2
Fallsington, Penn.	3.6	28.6
Oxford Valley	3.0	25.6
Hulmeville	3.6	22.0
Andalusia	5.3	16.7
Red Lion Inn	1.5	15.2
Torresdale	0.7	14.5
Holmesburg	2.3	12.2
Philadelphia	12.2	0.0

Philadelphia-Washington, 139.4 Miles.

	Miles to	Total Miles
	Out Return	
Philadelphia	0.0	139.4
Darby	6.3	133.1
Glenolden	1.9	131.2
Norwood	1.1	130.1
Eddystone	3.2	126.9
Chester	1.1	125.8
Marcus Hook	4.9	120.9
Claymont, Del.	1.6	119.3
Holly Oak	1.1	118.2
Wilmington	5.2	113.0
Elsmere Jct.	3.1	109.9
Price's Corner	1.7	108.2

Marshalltown	0.8	32.0	107.4
Newark	8.0	40.0	99.4
Elkton, Md.	6.6	46.6	92.8
North East	6.0	52.6	86.8
Perryville	8.3	60.9	78.5
Havre de Grace	0.9	61.8	77.6
Webster	4.2	66.0	73.4
Churchville	4.5	70.5	68.9
Belair	5.8	76.3	63.1
Kingsville	7.2	83.5	55.9
Carney	6.2	89.7	49.7
Baltimore	10.7	100.4	39.0
Elkridge	9.0	109.4	30.0
Laurel	12.0	121.4	18.0
Contee	2.0	123.4	16.0
Beltsville	3.5	126.9	12.5
Hyattsville	6.5	133.4	6.0
Bladensburg	0.5	133.9	5.5
Washington	5.5	139.4	0.0

Washington-Cumberland, 139.7 Miles.

	Miles to	Total Miles
	Out Return	
Washington	0.0	139.7
Bethesda	7.4	132.3
Rockville	7.9	124.4
Gaithersburg	5.2	119.2
Clarksburg	8.0	111.2
Hyattstown	3.9	107.3
Fredrick	11.3	96.0
Braddock Heights	3.0	46.7
Middletown	5.0	51.7

Claysville	10.0	109.0	23.0
West Alexander, W. Va.	7.0	116.0	16.0
Wheeling	16.0	132.0	0.0

Wheeling-Columbus, 128.1 Miles.

	Miles to	Total Miles
	Out Return	
Wheeling	0.0	128.1
Bridgeport	1.2	126.9
St. Clairsville	9.7	117.2
Lloydsville	5.2	112.0
Morristown	3.8	108.2
Hendricksburg	5.7	102.5
Fairview	3.4	99.1
Washington	11.6	87.5
Cambridge	8.4	79.1
New Concord	8.3	70.8
Norwich	3.2	60.5
Zanesville	11.9	55.7
Sterling	8.1	47.6
Brownsville	5.8	41.8
Linnville	4.7	37.1
Jacktown	4.0	33.1
Hebron	4.0	29.1
Kirksville	6.0	23.1
Etna	6.6	11.6



The Antiquity of Santa Fe is Shown by the Old Spanish Governor's Palace, Above, and the Several Other Points of Interest.

Boonsboro	8.0	59.7	80.0
Benevola	3.0	62.7	77.0
Hagerstown	8.0	70.7	69.0
Clear Springs	12.0	82.7	57.0
Indian Springs	4.0	86.7	53.0
Hancock	11.0	97.7	42.0
Bellegrove	13.0	110.7	29.0
Piney Grove	4.0	114.7	25.0
Pratt	8.0	122.7	17.0
Gilpen	3.0	125.7	14.0
Flintstone	1.0	126.7	13.0
Cumberland	13.0	139.7	0.0

Cumberland-Wheeling, 132 Miles.

	Miles to	Total Miles
	Out Return	
Cumberland	0.0	132.0
Elkhart Mines	9.0	123.0
Frostburg	2.0	121.0
Grantville	14.0	107.0
Keyser Ridge	6.0	101.0
Addison	5.0	96.0
Somerfield	4.0	92.0
Farmington	10.0	82.0
Fort Necessity	1.5	80.5
Chalk Hill House	3.0	77.5
Summit	1.5	76.0
Uniontown	6.0	70.0
Brownsville	12.0	58.0
Scenery Hill	12.0	46.0
Washington	13.0	33.0

Reynoldsville	4.4	116.0	12.1
Columbus	12.1	128.1	0.0

Columbus-Indianapolis, 176.4 Miles.

	Miles to	Total Miles
	Out Return	
Columbus	0.0	176.4
Alton	9.4	167.0
W. Jefferson	5.0	162.0
Lafayette	7.4	154.6
Summerford	4.7	149.9
Brighton	3.8	146.1
Vienna	2.6	143.5
Harmony	4.6	138.9
Springfield	5.9	133.0
Enon	7.8	125.2
Fairfield	6.2	119.0
Harshman	6.3	112.7
Dayton	4.1	108.6
Kingsville	4.8	103.8
New Lebanon	5.7	98.1
Johnsville	1.9	96.2
W. Alexandria	6.0	90.2
Eaton, O.	5.5	84.7
Richmond, Ind.	15.9	68.8
Centerville	6.1	62.7
Cambridge City	9.3	53.4
Lewistown	9.8	43.6
Knightstown	9.4	34.2
Greenfield	13.0	21.2
Indianapolis	21.2	0.0

Indianapolis-Terre Haute, 70.4 Miles.

	Miles to	Total Miles	Out Return
Indianapolis	0.0	0.0	70.4
Bridgeport	9.0	9.0	61.4
Plainfield	4.8	13.8	56.6
Belleville	4.9	18.7	51.7
Stilesville	8.2	26.9	43.5
Mt. Meridan	7.0	33.9	36.5
Coatsville	6.1	40.0	30.4
Reelsville	5.9	45.9	24.5
Harmony	5.9	51.8	18.6
Brasil	3.1	54.9	15.5
Seeleyville	7.6	62.5	7.9
Terre Haute	7.9	70.4	0.0

Terre Haute-St. Louis, 172 Miles.

	Miles to	Total Miles	Out Return
Terre Haute	0.0	0.0	172.0
Marshall, Ill.	16.8	16.8	155.2
Martinsville	10.8	27.6	144.4
Casey	6.3	33.9	138.1
Greenup	9.8	43.7	128.3
Teutopolis	18.4	62.1	109.9
Emmigham	3.9	66.0	106.0
Altamont	14.4	80.4	91.6
Vandalia	19.8	100.2	71.8
Hagerstown	4.3	104.5	67.5
Mulberry	6.8	111.3	60.7

New Franklin	15.7	30.1	129.1
Booneville	3.0	33.1	126.1
Arrow Rock	20.5	53.6	105.6
Marshall	16.9	70.5	88.7
Waverly	21.8	92.3	66.9
Dover	11.2	103.5	55.7
Lexington	11.0	114.5	44.7
Wellington	7.3	121.8	37.4
Levasy	10.5	132.3	26.9
Independence	17.9	150.2	9.0
Centropolis	4.2	154.4	4.8
Kansas City	4.5	159.2	0.0

Kansas City-Emporia, 134.1 Miles.

	Miles to	Total Miles	Out Return
Kansas City	0.0	0.0	134.1
Martin City	16.4	16.4	117.7
Olathe	12.4	28.8	105.3
Edgerton	17.9	46.7	87.4
Ottawa	24.5	71.2	62.9
Williamsburg	17.2	88.4	45.7
Waverly	13.1	101.5	32.6
Emporia	32.6	134.1	0.0

Emporia-Hutchinson, 122.3 Miles.

	Miles to	Total Miles	Out Return
Emporia	0.0	0.0	122.3
Cottonwood			
Falls	21.8	21.8	100.5

Syracuse-La Junta, 115.5 Miles.

	Miles to	Total Miles	Out Return
Syracuse	0.0	0.0	115.5
Holly	22.0	22.0	93.5
Granada	17.7	39.7	75.8
Lamar	17.6	57.3	58.2
Prowers	8.1	65.4	50.1
Las Animas	28.3	93.7	21.8
La Junta	21.8	115.5	0.0

La Junta-Trinidad, 91.3 Miles.

	Miles to	Total Miles	Out Return
La Junta	0.0	0.0	91.3
Timpas	23.3	23.3	68.0
Thatcher	31.5	54.8	36.5
Kadrew	21.4	76.2	15.1
El Mora	11.4	87.6	2.7
Trinidad	3.7	91.3	0.0

Trinidad-Las Vegas, 141 Miles.

	Miles to	Total Miles	Out Return
Trinidad	0.0	0.0	141.0
Raton, N. M.	25.4	25.4	115.6
Maxwell	28.7	54.1	86.9
French	4.8	58.9	82.1
Springer	10.8	69.7	71.3
Wagon Mound	27.9	97.6	43.4
Watrous	22.9	120.5	20.5
Las Vegas	20.5	141.0	0.0

Las Vegas-Santa Fe, 75.2 Miles.

	Miles to	Total Miles	Out Return
Las Vegas	0.0	0.0	75.2
Tecolote	12.0	12.0	63.2
Bernal	6.2	18.2	57.0
Pajarita	22.3	40.5	34.7
Rowe	2.3	42.8	32.4
Pecos	6.7	49.5	25.7
Glorieta	6.1	55.6	19.6
Canoncito	4.4	60.0	4.4
Santa Fe	15.2	75.2	0.0

Santa Fe-Albuquerque, 66.7 Miles.

	Miles to	Total Miles	Out Return
Santa Fe	0.0	0.0	66.7
Domingo	26.9	26.9	39.8
Algodones	14.3	41.2	25.5
Sandia	11.3	52.5	14.2
Alameda	6.2	58.7	8.0
Albuquerque	8.0	66.7	0.0

Albuquerque-McCarty's, 82.2 Miles.

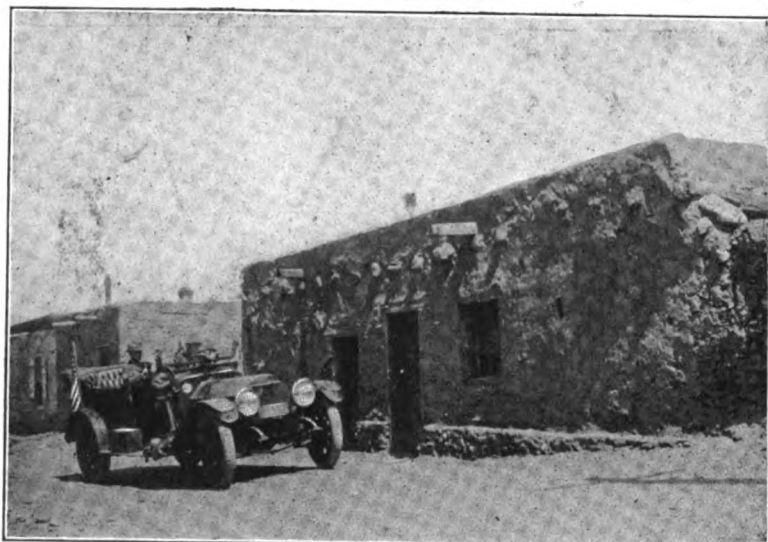
	Miles to	Total Miles	Out Return
Albuquerque	0.0	0.0	82.2
Atrisco	3.3	3.3	78.9
Laguna	45.0	48.3	33.9
Casa Blanca	6.8	55.1	27.1
McCarty's	27.1	82.2	0.0

McCarty's-Gallup, 76 Miles.

	Miles to	Total Miles	Out Return
McCarty's	0.0	0.0	76.0
Grant's	13.0	13.0	63.0
Toitce	4.0	17.0	59.0
Bluewater	8.0	25.0	51.0
Baca	8.0	33.0	43.0
Chaves	7.0	40.0	36.0
Thoreau	3.0	43.0	33.0
Gonzalez	7.0	50.0	26.0
Guam	4.0	54.0	22.0
Perea	4.0	58.0	18.0
Wingate	6.0	64.0	12.0
Gallup	12.0	76.0	0.0

Gallup-Holbrook, 124 Miles.

	Miles to	Total Miles	Out Return
Gallup	0.0	0.0	124.0
St. Michael's			
Aris	26.0	26.0	98.0
Wide Ruins	30.0	56.0	68.0
Navajo	25.0	81.0	43.0
Pinto	7.0	88.0	36.0
Petrified Forest	14.0	102.0	22.0
Carrizozo	9.0	111.0	13.0
Holbrook	13.0	124.0	0.0



Renowned Spot in Santa Fe, the Oldest House in the United States.

Greenville	8.7	120.0	52.0
Pocahontas	10.0	130.0	42.0
Highland	9.0	139.0	33.0
Collinsville	21.0	160.0	12.0
St. Louis, Mo.	12.0	172.0	0.0

St. Louis-Columbia, 140.7 Miles.

	Miles to	Total Miles	Out Return
St. Louis	0.0	0.0	140.7
Wellston	6.4	6.4	134.3
Pattonville	8.0	14.4	126.3
St. Charles	5.4	19.8	120.9
Colterville	11.0	30.8	109.9
Wentzville	14.3	45.1	95.6
Foristell	7.0	52.1	88.6
Wright City	4.5	56.6	84.1
Warrenton	9.3	65.9	74.8
Jonesburg	9.8	75.7	65.0
Danville	13.0	88.7	52.0
Mineola	2.7	91.4	49.3
Calwood	17.7	109.1	31.6
Fulton	7.9	117.0	23.7
Millersburg	11.1	128.1	12.6
Columbia	12.6	140.7	0.0

Columbia-Kansas City, 159.2 Miles.

	Miles to	Total Miles	Out Return
Columbia	0.0	0.0	159.2
Bocheport	14.4	14.4	144.8

Hutchinson-Dodge City, 154.8 Miles.

	Miles to	Total Miles	Out Return
Hutchinson	0.0	0.0	154.8
Sterling	24.9	24.9	129.9
Lyons	9.5	34.4	120.4
Chase	9.7	44.1	110.7
Ellinwood	13.5	57.6	97.2
Great Bend	10.4	68.0	86.8
Kinsley	47.7	115.7	39.1
Spearville	22.0	137.7	17.1
Dodge City	17.1	154.8	0.0

Dodge City-Syracuse, 107.4 Miles.

	Miles to	Total Miles	Out Return
Dodge City	0.0	0.0	107.4
Colmarron	19.2	19.2	88.2
Ingalls	7.0	26.2	81.2
Garden City	26.8	53.0	54.4
Lakin	25.1	78.1	29.3
Kendall	16.9	95.0	12.5
Syracuse	12.4	107.4	0.0



Famous Winding Trail up La Bajada Hill on the Santa Fe Road.

Holbrook-Flagstaff, 117 Miles.

	Miles to	Total Miles	Out Return
Holbrook	0.0	0.0	117.0
Winslow	36.0	36.0	81.0
Leupp	28.6	64.6	52.4
Teachaco	10.8	75.4	41.6
Flagstaff	41.6	117.0	0.0

Flagstaff-Kingman, 174 Miles.

	Miles to	Total Miles	Out Return
Flagstaff	0.0	0.0	174.0
Borden	7.0	7.0	167.0
Bellemont	5.0	12.0	162.0
Maine	8.0	20.0	154.0
Chalender	4.0	24.0	150.0
Williams	12.0	36.0	138.0
McClellan	8.0	44.0	130.0
Ash Fork	12.0	56.0	118.0
Pinaveta Station	8.0	64.0	110.0
Crookton	5.0	69.0	105.0
Seligman	12.0	81.0	93.0
Chino	4.0	85.0	89.0
Audley	7.0	92.0	82.0
Pica	9.0	101.0	73.0
Yampai	5.0	106.0	68.0
Field's Station	2.0	108.0	66.0
Peach Springs	12.0	120.0	54.0
Cherokee	6.0	126.0	48.0
Truxton	6.0	132.0	42.0
Valentine	7.0	139.0	35.0
Macberry	5.0	144.0	30.0
Antares	7.0	151.0	23.0
Hualpai	7.0	158.0	16.0
Louise	14.0	172.0	2.0
Kingman	2.0	174.0	0.0

Kingman-Amboy, 154 Miles.

	Miles to	Total Miles	Out Return
Kingman	0.0	0.0	154.0
McConico	4.0	4.0	150.0
Yucca	21.0	25.0	129.0
Topcock	30.0	55.0	99.0
Needles	16.0	71.0	83.0
Klinefelter	12.0	83.0	71.0
Bannock	6.0	89.0	65.0
Homer	5.0	94.0	60.0
Goff's	8.0	102.0	52.0
Fenner	9.0	111.0	43.0
Danby	16.0	127.0	27.0
Cadiz	13.0	140.0	14.0
Amboy	14.0	154.0	0.0

Amboy-San Bernadino, 160 Miles.

	Miles to	Total Miles	Out Return
Amboy	0.0	0.0	160.0
Bagdad	7.0	7.0	153.0
Ash Hill	14.0	21.0	139.0
Ludlow	7.0	28.0	132.0
Lavie	9.0	37.0	123.0
Plagah	5.0	42.0	118.0
Bector	5.0	47.0	113.0

Newberry	14.0	61.0	99.0
Mincola	6.0	67.0	93.0
Daggett	6.0	73.0	87.0
Barstow	9.0	82.0	78.0
Todd	6.0	88.0	72.0
Hicks	6.0	94.0	66.0
Hellen	9.0	103.0	57.0
Oro Grade	10.0	113.0	47.0
Victorville	6.0	119.0	41.0
Hesperia	8.0	127.0	33.0
Cajon	13.0	140.0	20.0
Cony Dell Store	2.0	142.0	18.0
Devore Store	7.0	149.0	11.0
Vermont	2.0	151.0	9.0
San Bernadino	9.0	160.0	0.0

San Bernadino-Los Angeles, 89.9 Miles.

	Miles to	Total Miles	Out Return
San Bernadino	0.0	0.0	89.9
Riverdale	10.9	10.9	79.0
Bloomington	7.8	18.7	71.2
Etiwanda	12.2	30.9	59.0
N. Cucamonga	4.0	34.9	55.0
Upland	3.6	38.5	51.4
Ontario	2.8	41.3	48.6
Pomona	5.5	46.8	43.1
Lemoa	8.0	54.8	35.1
San Marino	17.9	72.7	17.2
Le Senda	2.0	74.7	15.2
Pasadena	4.4	79.1	10.8
Los Angeles	10.8	89.9	0.0

Los Angeles-Santa Barbara, 105.8 Miles.

	Miles to	Total Miles	Out Return
Los Angeles	0.0	0.0	105.8
Hollywood	7.7	7.7	98.1
Calabasas	21.0	28.7	77.1
Newberry Park	16.3	45.0	60.8
Camarillo	9.9	54.9	50.9
El Rio	8.1	63.0	42.8
Ventura	8.4	71.4	34.4
Carpenteria	22.5	93.9	11.9
Santa Barbara	11.9	105.8	0.0

Santa Barbara-Pasa Robles, 150.6 Miles.

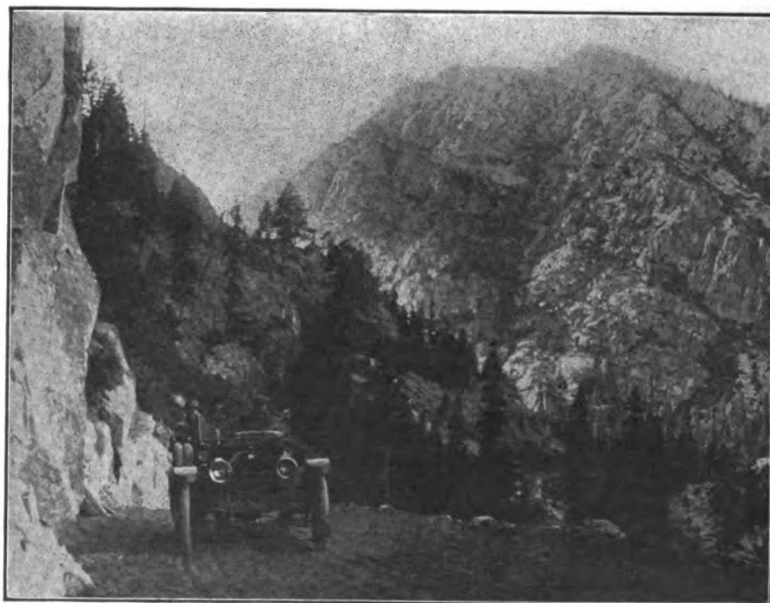
	Miles to	Total Miles	Out Return
Santa Barbara	0.0	0.0	150.6
Goleta	6.8	6.8	143.8
Los Cruces	30.0	36.8	113.8
Los Olivos	16.7	53.5	97.1
Sisquoc	21.7	75.2	75.4
Gary	1.5	76.7	73.9
Santa Maria	11.7	88.4	62.2
Arroyo Grande	16.1	104.5	46.1
Edna	8.9	113.4	37.2
San Luis Obispo	6.2	119.6	31.0
Santa Mar-			
garita	11.0	130.6	20.0
Templeton	14.3	144.9	5.7
Pasa Robles	5.7	150.6	0.0

Pasa Robles-Santa Cruz, 149 Miles.

	Miles to	Total Miles	Out Return
Pasa Robles	0.0	0.0	149.0
San Miguel	9.1	9.1	139.9
Bradley	10.9	20.0	129.0
Jolon	25.7	45.7	103.3
Greenfield	29.3	75.0	74.0
Soledad	8.5	83.5	65.5
Gonzales	8.6	92.1	56.9
Salinas	16.8	108.9	40.1
Castroville	8.7	117.6	31.4
Watsonville	12.4	130.0	19.0
Aptos	11.3	141.3	7.7
Sequel	3.6	144.9	4.1
Santa Cruz	4.1	149.0	0.0

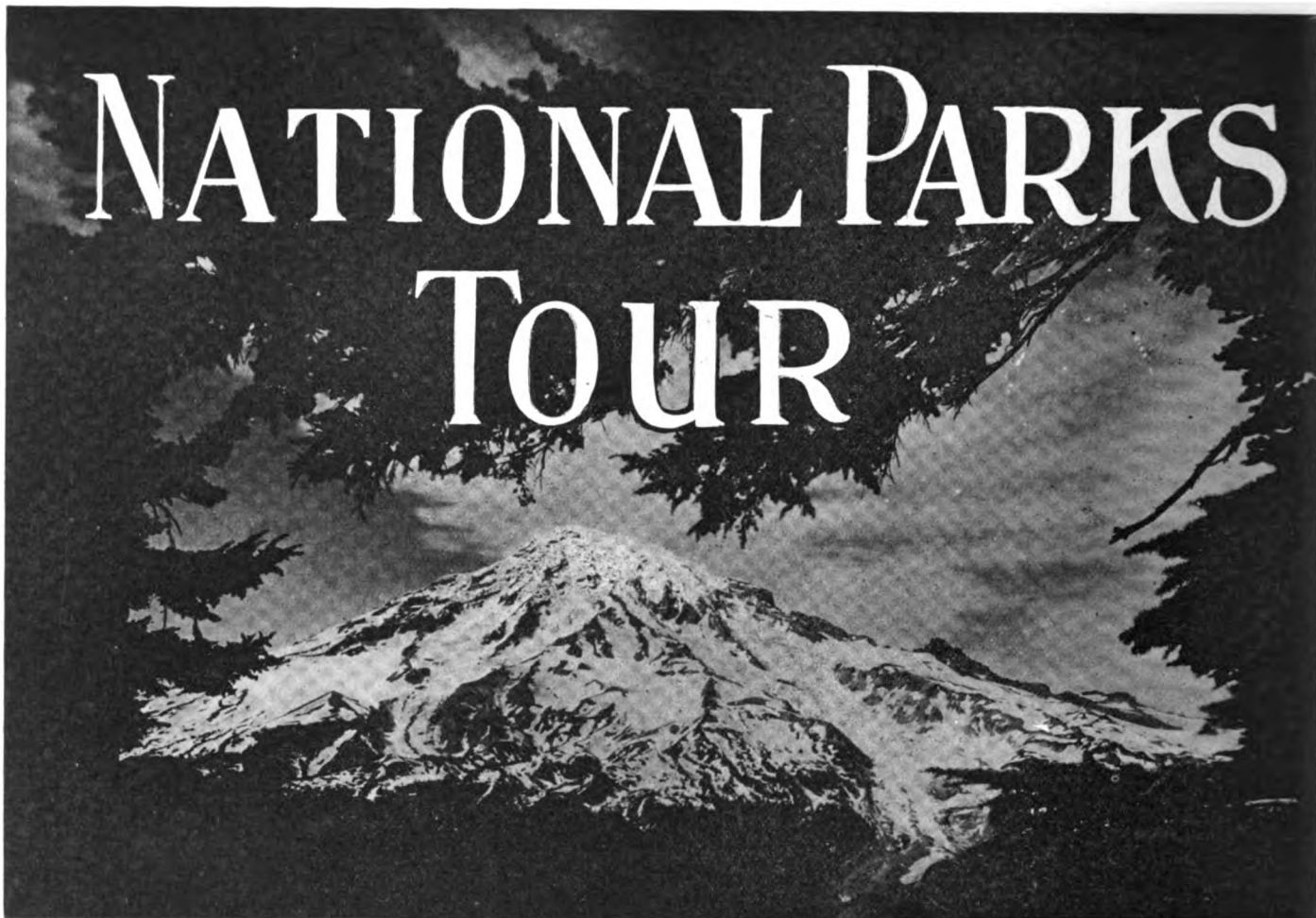
Santa Cruz-San Francisco, 90.9 Miles.

	Miles to	Total Miles	Out Return
Santa Cruz	0.0	0.0	90.9
Sequel	4.1	4.1	86.8
Los Gatos	21.6	25.7	65.2
San Jose	11.2	36.9	54.0
Santa Clara	3.9	40.8	50.1
Redwood City	20.5	61.3	29.6
San Mateo	6.6	67.9	23.0
S. San Francisco	10.0	77.9	13.0
San Francisco	13.0	90.9	0.0



Along a Roadway Blasted in the Side of the Sierra Nevadas.

NATIONAL PARKS Tour



Great Lakes to Pacific Ocean.



COMBINING all the points that go toward making a tour interesting, pleasant and comfortable, there is probably no route in America that is equal to the Yellowstone Trail, which leads the tourist from Chicago out through the three great national parks, Yellowstone, Glacier and Mt. Ranier. This route is also known as the National Parks Highway and formerly was known as the Lewis & Clarke trail. The original route lay out of Chicago in a northwesterly direction through the great parks to Seattle, but during the past year it has been extended by the placing of road marks, showing a route all the way from Cape Cod, Mass. This itinerary, however, will lead from Chicago westward, as the eastern highways that have been made a part of the trail are covered in other maps and descriptions.

From Chicago the first day's run goes north through Milwaukee to Madison. The early part of the route lies through a thickly settled suburban district. Evanston, the first town, has some of the finest residences in the United States. Northwestern university is located here. At Highland park is Northwestern Military academy, and Fort Sheridan, one of the largest military posts in the

United States is passed. A little further north is the naval training school. Kenosha and Racine are well known manufacturing cities. This entire district in southern Wisconsin is dotted with many small and very attractive lakes, where fish abound.

Out of Milwaukee to Madison the route lies through a farming country of great prosperity and passes many of the famous southern Wisconsin lakes. For a time it runs along the shore of Pewaukee lake. The town of Oconomowoc is almost completely surrounded by lakes and from here many attractive local trips are possible.

Rocky country with many curious formations is traversed on the road from Madison to La Crosse. The roads in general are good, although near Elroy there is a long stretch of sand. This will present no difficulties, however, to a good car.

Baraboo is the winter quarters of Ringling Brothers' circus and is the permanent home of its owners. There are many Indian mounds of great age in the vicinity. Devil's lake, about which there are many very curious rock formations, is easily reached from Baraboo. This lake is noted for its attractions. The famous "Dells

of Wisconsin" are only a short distance north of Baraboo, at Kilbourne.

Out of Ablemans the rocks on each side of the road rise sheer for 100 feet. For some distance the road goes along St. Joseph's ridge, from the top of which, as the tourist nears La Crosse, a magnificent view of the Mississippi valley is obtainable.

If one prefers rough hills, but fine scenery to a better road, some very fine views of the Mississippi may be had on the route from La Crosse to St. Paul. The more direct route goes through Winona, an important grain shipping point, and Rochester, which is famous all over the world as the seat of St. Mary's Surgical hospital, where two famous physicians, the Mayo brothers, treat every year 15,000 patients, who come to them from all parts of the world.

St. Paul and Minneapolis are known everywhere as the Twin cities. They are 10 miles apart and have been so nearly equal in size that the term "twin" has been deemed appropriate.

West from the Twin Cities the route lies through the rich farming and dairying country of southern Minnesota.

In the western part of Dakota

are the famous Bad Lands. They present a bewildering maze of barren rocks, buttes and hills of fanciful shape, made beautiful by a remarkable variety of strange colorings.

Montana is famous for its copper and cattle. The great cattle ranges are now disappearing before the gradual increase in the number of small farms. Government irrigation projects at various points are making the once barren land fertile. Population becomes more dense every year.

At Livingston a branch road goes south to Gardiner, which is the gateway to Yellow Stone park. This wonderful national reserve is one of the most beautiful scenic spots in the world.

Westward from Livingston the foot hills of the Rockies become larger and shortly the main ranges come into view. After passing Bozeman the tourist traverses the Gallatin valley and comes upon three forks, where the Gallatin, Madison and Jefferson rivers combine to make the Missouri.

The road climbs gradually up the mountains until, just east of Butte the tourist goes over the continental divide at an elevation of 6950 feet.

Butte is the largest mining camp in the world. But the roughness of the early camp days has disappeared and it is now a modern, well built city. It is possible here to visit one of the great mines and see how copper is taken from the earth at great depths. Anaconda, a little further on, is another copper city. The Washoe smelter is the largest in the world.

From here the road goes via Deer Lodge and the canyon of the Hell Gate river to Missoula. There are four possible routes from Missoula across Idaho. One of these leads north through Ravalli to Kalispel and the Glacier National park. This park was set aside as a public reservation in 1910. It contains Lake McDonald, a charming mountain lake two miles wide and 10 miles long. Steamers and launches on Lake McDonald make daily trips up and down during the park season. Among the other chief attractions are Avalanche Basin, Granite Park, Sperry Glacier, Blackfoot Glacier, McDonald Creek, Lincoln Peak, Gunsight Pass, Harrison Glacier, Iceberg Lake, Lake McDermott, and at somewhat greater distances are the Lake St. Mary country, Two Medicine Lake Country, Cutbank Canyon, Triple Divide Mountain, Red Eagle Lake, the Garden Wall and scores of other points of the greatest interest.

From Kalispel to Spokane an extremely interesting section is traversed. It touches the shores

of rivers and runs through the gorges reaching Pend D'Oreille lake, one of the largest bodies of fresh water in the United States, not including the great lakes. Near Bonner's ferry the tourist enjoys the remarkable Canon of the Kootenai. The coloring of the rocks, water and sky are very striking.

Before reaching Spokane the road goes through the famous Couer D'Alene mining district, made noteworthy some years ago by a great labor war, which led to

ed on the Columbia river, half way between Seattle and Spokane. The vineyards and orchards of the district surround it. The soil here is very rich and wherever water is available a luxuriant vegetation grows.

Crossing and recrossing the Columbia river the road goes up the Kittitas valley to Ellensburg and to Lake Keechelus. From the head of the lake Snoqualmie pass is entered. This crosses the Cascade mountains at a height of 3100 feet, after which the highway



Phantom Ship and Shore Line of Crater Lake, National Park.

the trials of Haywood, Moyer and Pettibone.

Westward from Spokane the Sunset boulevard leads through the Washington grain district to the valley of the Columbia river, disclosing the famous Wenatchee valley fruit district. Land here which could be had a few years ago for almost nothing, now sells for \$2000 an acre, as the result of irrigation. It is one of the greatest apple growing districts in the world and Wenatchee apples are sold all over the United States, in Europe and Australia.

The city of Wenatchee is locat-

drops rapidly over excellent roads to the city of Seattle.

Seattle is the largest city in the State of Washington. It began not so many years ago as the site of a saw mill. It has a magnificent harbor on Elliott bay, off Puget Sound. Across the harbor is Admiralty inlet, behind which rise the snow-capped peaks of the Olympian range of mountains.

From Seattle a short run southward through Tacoma brings the traveller to the Mt. Ranier National park and the snow covered sides of the great Mt. Ranier.



ITINERARY. CHICAGO-TACOMA.

Night Stops—Chicago, Ill.; Madison and La Crosse, Wis.; St. Paul and Alexandria, Minn.; Fargo, Jamestown, Bismarck and Dickinson, N. D.; Terry, Custer, Livingston, Butte and Drummond, Mont.; Wallace, Ida.; Spokane, Waterville, Cle Elum and Seattle, Wash. Eighteen Days, 2480.4 Miles.

Chicago-Madison, 170.8 Miles.

	Miles to	Total Miles
	Out	Return
Chicago	0.0	0.0
Evanston	13.3	13.3
Hubbard's Hill	5.7	19.0
Ravina Park	3.9	22.9
Highland Park	2.6	25.5
Highwood Station	1.6	27.1
Lake Forest	4.9	32.0
Waukegan	7.5	39.5
Zion City	6.2	45.7
Kenosha	9.6	55.3
Racine	10.7	66.0
S. Milwaukee	14.0	80.0
Milwaukee	9.4	89.4
Brookfield	13.2	102.6
Waukesha	3.7	106.3
Delafield	19.7	117.0
Johnson Creek	20.6	137.6
Lake Mills	6.8	144.4
Madison	26.4	170.8

Madison-La Crosse, 145.6 Miles.

	Miles to	Total Miles
	Out	Return
Madison	0.0	0.0
Ashton	10.1	10.1
Springfield Cor- ners	4.3	14.4
Sauk City	10.5	24.9
Baraboo	17.3	42.2
Abelmanns	9.4	51.6
Reedsburg	8.2	59.8
Lavalle	7.8	67.6
Union Center	11.9	79.5
Elroy	4.6	84.1
Kendalls	7.1	91.2
Ontario	13.6	104.8
Cashton	10.2	115.0
Portland	5.8	120.8
La Crosse	24.8	145.6

La Crosse-St. Paul, 162.1 Miles.

	Miles to	Total Miles
	Out	Return
La Crosse	0.0	0.0
La Crescent, Minn.	3.3	3.3
Ridgeway	17.7	21.0
Witoka	3.6	24.6
Winona	9.5	34.1
Lewiston	14.5	48.6
Utica	4.6	53.2
St. Charles	5.9	59.1
Rochester	21.9	81.0
Pine Island	18.1	99.1
Zugabrota	6.5	105.6
Cannon Falls	19.9	125.5
St. Paul	36.6	162.1

St. Paul-Alexandria, 148.7 Miles.

	Miles to	Total Miles
	Out	Return
St. Paul	0.0	0.0
Minneapolis	9.9	9.9
Osseo	12.3	22.2
Anako	6.2	28.4
Elk River	11.6	40.0
Becker	16.9	56.9
Clear Lake	7.0	63.9
Cable	6.0	69.9
St. Cloud	6.3	76.2
St. Joe	7.3	83.5
Avon	7.3	90.8
Albany	7.1	97.9
Helrose	15.0	112.9
Sauk Center	8.9	121.8
Alexandria	26.9	148.7

Alexandria-Fargo, 124.2 Miles.

	Miles to	Total Miles
	Out	Return
Alexandria	0.0	0.0
Fargo	124.2	124.2



Old Faithful Geyser, Yellowstone National Park.

	Miles to	Total Miles
	Out	Return
Garfield	7.1	7.1
Brandon	6.5	13.6
Evansville	6.2	19.8
Melby	5.9	25.7
Fergus Falls	28.6	54.3
Robtssay	22.9	77.2
Barnesville	17.2	94.4
Fargo	29.8	124.2

Fargo-Jamestown, 99 Miles.

	Miles to	Total Miles
	Out	Return
Fargo	0.0	0.0
Valley City	61.3	61.3
Jamestown	37.7	99.0

Jamestown-Bismarck, 108.5 Miles.

	Miles to	Total Miles
	Out	Return
Jamestown	0.0	0.0
Bismarck	108.5	108.5



The Snow-Crested Rockies.

Dawson 55.2 55.2 53.3
Bismarck 53.3 108.5 0.0
Bismarck-Dickinson, 120.2 Miles.

	Miles to	Total Miles
	Out	Return
Bismarck	0.0	0.0
Hebron	79.2	79.2
Dickinson	41.0	120.2

Dickinson-Terry, 160.7 Miles.

	Miles to	Total Miles
	Out	Return
Dickinson	0.0	0.0
Sentinel Butte	60.4	60.4
Glendive	55.6	116.0
Fallon	33.5	149.5
Terry	11.2	160.7

Terry-Custer, 142.3 Miles.

	Miles to	Total Miles
	Out	Return
Terry	0.0	0.0
Miles City	39.3	39.3
Forsyth	51.6	90.9
Custer	51.7	142.6

Custer-Livingston, 185.5 Miles.

	Miles to	Total Miles
	Out	Return
Custer	0.0	0.0
Billings	57.7	57.7
Reed Point	67.0	124.7
Livingston	60.8	185.5

Livingston-Butte, 139.2 Miles.

	Miles to	Total Miles
	Out	Return
Livingston	0.0	0.0
Boxeman	26.7	26.7
Three Forks	34.8	61.5
Whitehall	43.6	105.1
Butte	34.1	139.2

Butte-Drummond, 86.6 Miles.

	Miles to	Total Miles
	Out	Return
Butte	0.0	0.0
Anaconda	25.8	25.8
Deer Lodge	26.5	52.3
Garrison	11.5	63.8
Drummond	22.8	86.6

Drummond-Wallace, 181.5 Miles.

	Miles to	Total Miles
	Out	Return
Drummond	0.0	0.0
Bearmount	13.5	13.5
Missoula	44.6	58.1
Wallace	123.4	181.5

Wallace-Spokane, 86 Miles.

	Miles to	Total Miles
	Out	Return
Wallace	0.0	0.0
Kellogg	11.6	11.6
Coeur D'Alene	40.7	52.3
Spokane	33.7	86.0

Spokane-Waterville, 145.4 Miles.

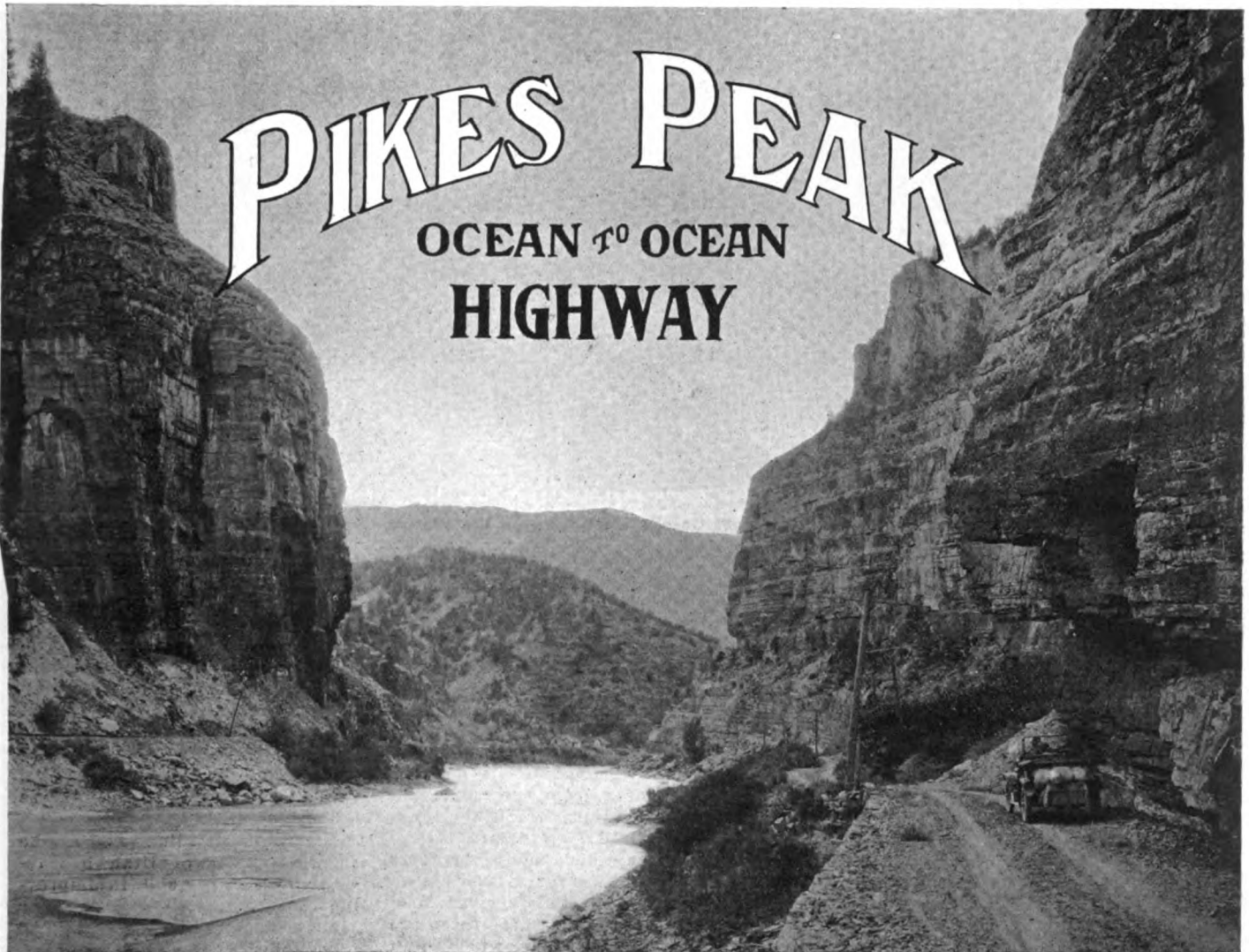
	Miles to	Total Miles
	Out	Return
Spokane	0.0	0.0
Davenport	36.8	36.8
Creston	22.3	59.1
Wilbur	8.8	67.7
Almira	13.0	80.7
Coulee City	22.7	103.4
Waterville	42.0	145.4

Waterville-Cle Elum, 91.1 Miles.

	Miles to	Total Miles
	Out	Return
Waterville	0.0	0.0
Wenatchee	26.8	26.8
Peshastin	20.4	47.2
Cle Elum	43.9	91.1

Cle Elum-Seattle, 112 Miles.

	Miles to	Total Miles
	Out	Return
Cle Elum	0.0	0.0
Easton	15.5	15.5
Laconia	20.7	36.2
Bld-A-Wee	12.1	48.3
North Bend	13.3	62.1
Redmond	24.2	86.3
Seattle	25.7	112.0



Scenic Tour In Central Rockies.

THE Pikes Peak Ocean to Ocean Highway serves as a connecting link between the Lincoln Highway on the north and the National Old Trails road on the south, running as it does from Kansas City, where the latter trail crosses, into Salt Lake City, where it joins the Lincoln Highway. Tourists who cross the country on either of the trunk highways find the Pikes Peak Ocean to Ocean Highway a pleasant detour, either taking it on the trip eastward at Salt Lake City or at Kansas City going westward. The roads over this highway are not only in fairly good condition, but this trip across Kansas, Colorado and into Utah affords views which for scenic splendor are unexcelled, particularly in the mountainous sections, where one enjoys an environment equalled no where in the world.

Through Kansas the tourist will see chiefly the great western wheat country, and will travel on good roads if the weather is dry. Across the rolling prairies of eastern Colorado the road material is a sandy loam or gravel with a lit-

tle adobe or clay. Every county along the way is making great effort to improve and shorten the road.

As the tourist goes westward the dim outline of Pikes Peak becomes more positive. In the Pikes Peak region the first of the real mountain scenery is unfolded to the traveller. It is a region of wonders and no area of equal size on the continent can offer so great a variety of scenery, all of which is so easily accessible.

Among the many things there to fascinate the visitor is the great mountain itself, up which a new road has just been completed by private enterprise—a wide and safe mountain highway of very moderate grades, up which any driver can pilot even an ordinarily good car.

Then there is the Garden of the Gods, North Cheyenne Canon, the High Drive, Williams Canon, the Cave of the Winds, Crystal Park, South Cheyenne Canon, Seven Falls, Mt. Manitou Park, Glen Eyrie, Red Mountain, the Cliff Dwellings, Palmer Park and

Stratton Park. Good automobile roads lead to all these points and if the tourist wishes he may spend several days in delightful side trips.

Colorado Springs is the centre of this remarkable country and from it a great variety of trips may be made—to Denver, Pueblo, the Royal Gorge, Florence and Canon City. Manitou is at the foot of the White mountains, where the road enters Ute pass.

There are numerous resorts along this part of the trip, at which the tourist may stop. They include Cascade, Green Mountain Falls, Crystola and Woodland park. At Divide of Florissant there is an opportunity for a side trip to Cripple Creek the world's greatest gold mining district in the volume of production.

At Lake George the tourist comes upon the fishing country and in all the mountain streams from this point on it is possible to capture the fine mountain trout for which Colorado is famous.

Climbing out of South Park, over Trout Creek pass, the tourist





Climbing the Forested Side of Cascade Mountain on the Way to the Summit of Pikes Peak.

passes the Castle Rocks in Trout Creek Canon and gets his first view of the continental divide just across the valley with Mt. Harvard, Mt. Yale, Mt. Princeton and all the peaks of the Collegiate Range just ahead.

Buena Vista is a modern town near the fishing and camping grounds of Cottonwood lake. Its swimming pools are fed by hot water from nearby springs.

For the first miles up the Arkansas river the road runs along the bottom of the gorge, with great cliffs overhanging on either side. Sixteen miles above Buena Vista it crosses the river and takes up a course where it has been cut directly into the side of the cliffs, 600 feet above the river. The next stop is Granite, one of the oldest mining camps in Colorado.

From Granite to Leadville are two roads, one known as the river road and the other passing Twin lakes. The view of these lakes from a motor car is said to equal anything that Switzerland has to offer.

A new road through Independence pass crosses the continental divide at a height of 12,000 feet above sea level, although none of the grades approaching it are greater than six per cent.

From Leadville to the top of Tennessee pass the road follows an abandoned four per cent. grade of an old narrow gauge railroad. Coming down the Pacific side of the continental divide the grades are more noticeable.

The way runs into Eagle Canon and its passage through the gorge is a wonderful scenic trip, which reaches its climax as the tourist rounds Eagle mountain and is able to look back over the road he has been following. Along the top of this mountain the view is very impressive and it may take the breath of the unaccustomed mountaineer as he looks down upon the mining camps, hanging

to the precipitous sides of the mountain.

Continuing through Red Cliff, Gilman, Minturn, Eagle and Gypsum, settlements in the heart of fine fishing country, the road enters the canon of the Grand river. This trip is perhaps the greatest scenic feature of the route.

It begins at Glenwood Springs, which is famous for its hot water bubbling from the earth and its beautiful drives about Hanging lake. It is a resort in the mountains which many travellers will wish to see for several days.

Further westward the road passes Newcastle, where there are coal mines, and Rifle, which is an outfitting point for the big game country, made famous by President Roosevelt's hunt there some years ago. Here the tourist comes upon the fine orchard section of the western slope, and passes

through the remarkable fruit raising country of the Grand river valley.

Sometimes the road follows the valley and sometimes it goes along the tops of the Mesas. The ride down Plateau Creek, between the Palisades, is an interesting experience. Through the town of Palisades and Clifton the road again passes a rich orchard section, continuing as far as Grand Junction.

From the Utah line to Salt Lake City the State of Utah has recently spent \$50,000 in improving the roads.

ITINERARY. PIKES PEAK.

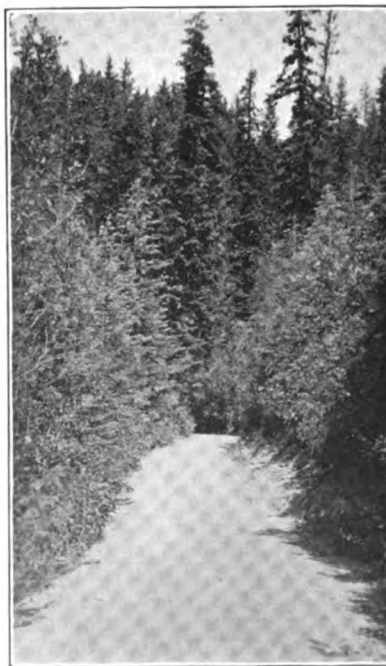
Night Stops—Kansas City, Mo.; Topeka, Salina, Waukeaney and Colby, Kan.; Limon, Colorado Springs, Leadville, Glenwood Springs, Meeker, Col.; Vernal, Colton, Salt Lake City, Utah. Twelve Days, 1302.8 Miles.

Kansas City-Topeka, 78.5 Miles.

	Miles to	Total Miles	Out	Return
Kansas City	0.0	0.0	78.5	
Muncie	10.0	10.0	68.5	
Bonner Springs	8.0	18.0	60.5	
Lenape	6.8	24.8	53.7	
De Soto	2.3	27.1	51.4	
Eudora	9.5	36.6	41.9	
Lawrence	8.2	44.8	33.7	
Midland	3.0	47.8	30.7	
Buck Creek	5.5	53.3	25.3	
Perry	7.2	60.5	18.0	
Grantville	10.5	71.0	7.5	
Topeka	7.5	78.5	0.0	

Topeka-Salina, 132.3 Miles.

Miles to		Total Miles
	Out	Return
Topeka	0.0	0.0 132.3
Silver Lake	13.8	13.8 118.5
Kingsville	2.6	16.4 115.9
Rossville	3.1	19.5 112.8
St. Marys.....	7.4	26.9 105.4
Belvue	7.2	34.1 98.2
Wamego	7.8	41.9 90.4
St. George	5.7	47.6 84.7
Manhattan	12.7	60.3 72.0
Ogden	12.2	72.5 59.8
Fort Riley	5.5	78.0 54.3
Junction City.....	4.0	82.0 50.3



A Woodland Vista.

Chapman	15.0	97.0	35.3
Detroit	4.0	101.0	31.3
Ablene	6.3	107.3	25.0
Solomon	9.0	116.3	16.0
Salina	16.0	132.3	0.0

Salina-Waukeaney, 143 Miles.

	Miles to	Total Miles	Out Return
Salina	0.0	0.0	143.0
Bavaria	8.5	8.5	134.5
Brookville	6.5	15.0	128.0
Carnegie	10.0	25.0	118.0
Kanopolis	8.5	33.5	109.5
Ellsworth	10.5	44.0	99.0
Wilson	14.0	58.0	85.0
Dorrance	7.5	65.5	77.5
Bunker Hill	7.5	73.0	70.0
Russell	9.5	82.5	60.5
Gorham	8.7	91.2	51.8
Walker	3.0	94.2	48.8
Victoria	4.0	98.2	44.8
Hays	10.5	108.7	34.3
Ellis	15.0	123.7	19.3
Ogallah	10.5	134.2	8.8
Waukeaney	8.8	143.0	0.0

Waukeaney-Colby, 82.5 Miles.

	Miles to	Total Miles	Out Return
Waukeaney	0.0	0.0	82.5

Limon-Colorado Springs, 75.7 Miles.

	Miles to	Total Miles	Out Return
Limon	0.0	0.0	75.7
Mattison	21.2	21.2	54.5
Simla	6.2	27.4	48.3
Ramah	4.7	32.1	43.6
Calhan	9.6	41.7	34.0
Peyton	9.8	51.5	24.2
Falcon	9.0	60.5	15.2
Colorado Springs	15.2	75.7	0.0

Colorado Springs-Leadville, 140.8 Miles.

	Miles to	Total Miles	Out Return
Colorado Springs	0.0	0.0	140.8
Colorado City	2.3	2.3	138.5
Manitou	3.4	5.7	135.1
Cascade	4.3	10.0	130.8
Green Mountain			
Falls	3.7	13.7	127.1
Crystola	2.0	15.7	125.1
Edlowe	5.0	20.7	120.1
Divide	3.4	24.1	116.7
Florissant	8.8	32.9	107.9
Lake George	5.3	38.1	102.7
Lidderdale	2.0	40.1	100.7
Springer	4.2	44.3	96.5
Idlewild	3.0	47.3	93.5

Sherwood	2.5	49.7	38.8
Ortega	3.0	52.7	35.8
Eagle	5.0	57.7	30.8
Gypsum	5.9	63.6	24.9
Dotsera	6.8	70.4	18.1
Shoshone	7.8	78.2	10.3
Grisley	5.0	83.2	5.3
Glenwood Springs	5.3	88.5	0.0

Glenwood Springs-Meeker, 75.9 Miles.

	Miles to	Total Miles	Out Return
Glenwood Springs	0.0	0.0	75.9
South Canon	3.8	3.8	72.1
Chacra	3.8	7.6	68.3
New Castle	7.9	15.5	60.4
Chapman	4.0	19.5	56.4
Silt	6.7	26.2	49.7
Antlers	3.2	29.4	46.5
Rifle	4.0	33.4	42.5
Meeker	42.5	75.9	0.0

Meeker-Vernal, 118 Miles.

	Miles to	Total Miles	Out Return
Meeker	0.0	0.0	118.0
Rangeley	61.0	61.0	57.0
"K" Ranch	22.0	83.0	35.0



Gateway to the Garden of the Gods, Colorado Springs.

Voda	6.5	6.5	76.0
Collyer	5.4	11.9	70.6
Quinter	7.6	19.5	63.0
Buffalo Park	8.6	28.1	54.4
Grainfield	5.6	33.7	48.8
Grinnell	9.0	42.7	39.8
Campus	5.8	48.5	34.0
Oakley	6.5	55.0	27.5
Mingo	15.5	70.5	12.0
Colby	12.0	82.5	0.0

Colby-Limon, 149 Miles.

	Miles to	Total Miles	Out Return
Colby	0.0	0.0	149.0
Levant	8.8	8.8	140.2
Brewster	10.2	19.0	130.0
Goodland	18.0	37.0	112.0
Buelton	9.8	46.8	102.2
Kanorado	8.0	54.8	94.2
Burlington, Col.	13.0	67.8	81.2
Muskoka	8.5	76.3	72.7
Stratton	9.3	85.6	63.4
Vona	9.0	94.6	54.4
Siebert	6.7	101.3	47.7
Flagler	11.3	112.6	36.4
Arriba	11.9	124.5	24.5
Bovina	6.0	130.5	18.5
Genoa	5.8	136.3	12.7
Limon	12.7	149.0	0.0

Howber	3.0	50.3	90.5
Spinney	5.2	55.5	85.3
Hartsel	11.0	66.5	74.3
Haver	9.0	75.5	65.3
Bath	8.5	84.0	56.8
Newell	6.3	90.3	50.5
Buena Vista	10.0	100.3	40.5
Wild Horse	3.5	103.8	37.0
Americus	3.5	107.3	33.5
Barre	3.5	110.8	30.0
Waco	10.0	120.8	20.0
Snowden	11.0	131.8	9.0
Leadville	9.0	140.8	0.0

Leadville-Glenwood Springs, 88.5 Miles.

	Miles to	Total Miles	Out Return
Leadville	0.0	0.0	88.5
Keeldar	5.8	5.8	82.7
Climax	4.1	9.9	78.6
Mitchell	2.8	12.7	75.8
Pando	5.0	17.7	70.8
Redcliff	5.0	22.7	65.8
Belden	2.9	25.6	62.9
Minturri	4.3	29.9	58.6
Avon	7.2	37.1	51.4
Edwards	3.0	40.1	48.4
Allenton	3.1	43.2	45.3
Wolcott	4.0	47.2	41.3

Jensen	19.4	102.4	15.6
Vernal	15.6	118.0	0.0

Vernal-Colton, 115.5 Miles.

	Miles to	Total Miles	Out Return
Vernal	0.0	0.0	115.5
Moffat	22.5	22.5	93.0
Roosevelt	10.2	32.7	82.8
Myton	11.1	43.8	71.7
Duchesne	21.1	64.9	50.6
Colton	50.6	115.5	0.0

Colton-Salt Lake City, 103.1 Miles.

	Miles to	Total Miles	Out Return
Colton	0.0	0.0	103.1
Thistle	33.7	33.7	69.4
Spanish Forks	13.3	47.0	56.1
Springville	4.8	51.8	51.3
Provo	6.0	57.8	45.3
Pleasant Grove	10.5	68.3	34.8
Alpine	3.2	71.5	31.6
Lehi	2.6	74.1	29.0
Salt Lake City	29.0	103.1	0.0



Through Sunny Southern Climes.

IT WOULD hardly be possible to suggest a more suitable routing to the majority of tourists than over the Dixie Highway from the Great Lakes region to the lower end of Florida. The Dixie Highway has the winter playgrounds of southern Georgia and Florida for those of the North and middle states driven out by the cold winter climate. It has a wonderland for summer tourists seeking a cool and inviting spot along the lakes in Michigan.

The Dixie Highway offers the attractions to tempt both the tourist of the North and South to visit each other. He can make the entire trip from six to 10 days in his car. He has something to see of interest all the way.

Let us suppose that a tourist from the middle west starts from Chicago en route to Florida. Travelling over the Dixie Highway, which follows the old Military road, he can make Danville, Ill., on a leisurely run for the first night's stop, or if he prefers, he can push on to Indianapolis. Even the first day's run has shown a variety of attractions. A stop at Crawfords-

ville, Ind., and a pilgrimage to the home of Lew Wallace is worth while. Indianapolis is too well known to require any catalogue of her attractions for the tourists. Another day's journey over the highway brings the tourist to Louisville, that historic gateway and thriving city of the South. On the run from Indianapolis to Louisville the tourist travels over an excellent road through the good Indiana towns of Martinsville and Bloomington, the home of the state university. Near Bedford the tourist can visit the greatest quarries in the United States.

From Louisville to Nashville, Tenn., the tourist can travel over a good road, making this run of 250 miles in a day if he so desires.

When the highway is completed between Nashville and Chattanooga and the only remaining barrier to through travel from Michigan to Florida along the western division is removed, as it will be within 12 months, it will be possible for the tourist to leave Nashville in the morning and after travelling the 170 miles reach Chattanooga in the evening. The live and thriving

towns of Murfreesboro, Shelbyville, Tullahoma and Winchester are of interest. At Cowan the ascent of the Cumberland mountain will begin. The crossing of this famous mountain offers scenic attractions which will hardly be equalled elsewhere in the United States. Should the tourist care to tarry, good hotels are provided at Mont-eagle, the far famed chatauqua and assembly grounds. The Sequatchie valley greets the tourist on the descent, followed by varied scenic attractions all the way into Chattanooga.

As a result of the Dixie Highway activity, the State of Georgia in less than one year has provided a magnificent highway its entire length. It is now possible for a tourist to make Macon, Ga., in one day.

The tourist leaving Chattanooga can travel over the road made famous by Sherman's March to the Sea. Every mile of the run between Chattanooga and Atlanta is closely allied with stirring recollections of the great war between the North and the South. From Atlanta to Macon a perfect road is



The Jump-Off on Cumberland Mountain Near Dixie Highway.

provided for practically every mile over which the tourist can run his car at the maximum speed. Should he desire to reach west coast points in Florida, a fine route is provided along the western division straight through to Tallahassee, that quaint old capital of the State of Florida.

To reach Jacksonville and the east coast in the shortest possible time, the central division was selected. Over this road in its present condition it is now possible to make 256 miles in from 12 to 14 hours. To Waycross a perfect sand clay road of 186 miles is provided. At Folkston a crossing is made by ferry over the St. Mary's river.

The tourist having the time to spare will want to journey to Jacksonville by easy stages through the historic towns of Milledgeville, Sandersville, Louisville, Waynesboro, Savannah, Brunswick and Darien. From Macon to Savannah, a distance of 206 miles, a good road is provided. Leaving Chatham county, the oldest in the colony, the car travels over the old Oglethorpe road. Beyond this the tourist crosses the Fort Sunbury road, famous in revolutionary history.

Midway church, one of the oldest in America, is worthy of special visit. From Midway the motorist follows the road that Tomochichi, the Mico of the Yamacraws, cut out for Oglethorpe 183 years ago. Crossing the Altamaha at Darien, the tourist is permitted to travel the same road traversed by world renowned John Wesley and his brother Charles. The splendid road into Brunswick is through the celebrated Marshes of Glynn, made famous in the poem by Sidney Lanier.

A beautiful, well built road leads through a delightfully picturesque territory from Brunswick to the ferry over the Great Satilla river, named for a captain of the King's army, where Captain Messias, after his battle with the British at Plum Orchard, crossed in his retreat to Fort Barrington.

The road through Nassau county, while travelable at a rate of about 15 miles an hour, is yet to be surfaced. On reaching the Duval county line there is a perfect road for 25 miles leading into Jacksonville.

Should the tourist on leaving Macon take the western division with the intent of visiting the west coast of Florida, he will find at-

tractions of equal importance. The western division of the highway in Florida, leading from Tallahassee, through Perry, Gainesville, Ocala, Orlando, Kissimmee, Bartow and Arcadia, when completed will provide a main artery of travel from which any point in central, southern or on the west coast of Florida can be reached. Provisions have been made for the completion of the loop around the State of Florida by the addition of the Tamiami trail, which is being constructed through San Marco, Ft. Myers to Miami.

The tourist coming from the East has been provided for by the Dixie Highway Association in the eastern division, which connects with the loop around the State of Michigan at Detroit, and extends southward through Toledo, Bowling Green, Findlay, Lima, Troy, Dayton, Middletown to Cincinnati.

Crossing the Ohio river into Kentucky, the tourist on the eastern division soon reaches the Blue Grass country passing through the towns of Georgetown and Lexington.

Leaving Lexington over a splendid road, the tourist soon comes to the crossing of the Kentucky river, the "Hudson arm of the West." Here plans have been started for the construction of a high bridge over this river. Entering Madison county the tourist will want to spend a few hours visiting Boonesborough, which was one of the first settlements in Kentucky. The mountain counties of Rockcastle, Laurel, Knox and Bell are hard at work with steam shovels and other modern road equipment building the Dixie Highway, which will be open for through travel by late fall. This section of about 90 miles is the only barrier to through travel from Michigan to Florida over the western division. A tourist desiring to make the trip at the present time can ship their car from Richmond, Ky., to Knoxville, Tenn., at a cost of from \$20 to \$32. From Richmond, Ky., to Cumberland Gap, Tenn., the tourist travels over the trail blazed by Daniel Boone.

On crossing the Tennessee line



Under a Canopy of Date Palms in Daytona, Fla., One of the City's Famous Drives.

along the eastern division, the attractions of the old and the new are provided for the tourist in endless variety. A good road is provided all of the way from the Kentucky line into Knoxville.

From Knoxville to Chattanooga, a distance of 120 miles, the run can be made easily in from six to seven hours. This run is full of historic and scenic interest. When the barrier is removed along the eastern division in the mountains of Kentucky, it will be possible for the tourist to leave Detroit and reach Chattanooga in less than four days, if he is compelled to hurry. In two days he can reach Savannah and even Jacksonville. In two to three days more he can be in Miami.

The tourist going North can travel either along the eastern division to Detroit, or through Nashville, Louisville, Indianapolis and South Bend and reach the loop around the entire peninsula made by the Dixie Highway, which will make all of the noted Michigan resorts accessible to tourists.

ITINERARY. DIXIE HIGHWAY.

Night Stops—Danville, Ill.; Indianapolis, Ind.; Louisville, Ky.; Nashville, Tenn.; Chattanooga, Tenn.; Atlanta, Ga.; Macon, Ga.; Jacksonville, Fla.; Miami, Fla. Ten days. Total distance, 1585 Miles.

Chicago-Danville, Ill., 135.8 Miles.

	Miles to	Total Miles	Out Return
Chicago	0.0	0.0	135.8
Chicago Heights	28.8	28.8	107.0
Momence	25.2	54.0	81.8
Watseka	30.2	84.2	51.6
Hoopeston	23.0	107.2	28.6
Danville	28.6	135.8	0.0



A Cool Retreat at Sewanee, Tenn.

Danville, Ill.-Indianapolis, Ind., 88.9 Miles.

	Miles to	Total Miles	Out Return
Danville, Ill.	0.0	0.0	88.9
Covington, Ind.	12.8	12.8	76.1
Crawfordsville	29.7	42.5	46.4
Brownsburg	32.1	74.6	14.3
Indianapolis	14.3	88.9	0.0

Indianapolis, Ind.-Louisville, Ky., 147.6 Miles.

	Miles to	Total Miles	Out Return
Indianapolis	0.0	0.0	147.6
Martinsville	30.7	30.7	116.9
Bloomington	22.1	52.8	94.8
Bedford	24.6	77.4	70.2
Paoli	23.6	101.0	46.6
New Albany	41.3	142.3	5.3
Louisville, Ky.	5.3	147.6	0.0

Louisville-Nashville, 249.3 Miles.

	Miles to	Total Miles	Out Return
Louisville	0.0	0.0	249.3
Elizabethtown	45.3	45.3	204.0

Murfordsville	31.3	76.6	172.7
Cave City	57.5	134.1	115.2
Bowling Green	30.7	164.8	84.5
Russellville	29.2	194.0	55.3
Nashville	55.3	249.3	0.0

Nashville-Chattanooga, 140.1 Miles.

	Miles to	Total Miles	Out Return
Nashville	0.0	0.0	140.1
Lavergne	15.7	15.7	124.4
Murfreesboro	16.1	31.8	108.6
Beach Grove	17.2	49.0	91.1
Noah	4.8	53.8	86.3
Manchester	9.3	63.1	77.0
Hillsboro	8.3	71.4	68.7
Pelham	9.0	80.4	59.7
Monteagle	6.0	87.3	52.8
Assembly College	0.7	88.0	52.1
Tracy City	5.9	93.9	46.2
Sequatchie	16.4	110.3	29.8
Jasper	3.9	114.2	25.9
Hooker	12.8	127.0	13.1
St. Elmo	10.3	137.3	2.8
Chattanooga	2.8	140.1	0.0

Chattanooga-Atlanta, 139 Miles.

	Miles to	Total Miles	Out Return
Chattanooga	0.0	0.0	139.0
Summerville	45.1	45.1	93.9
Rome	25.4	70.5	68.5
Marietta	50.2	120.7	18.3
Atlanta	18.3	139.0	0.0

Atlanta-Macon, 94.5 Miles.

	Miles to	Total Miles	Out Return
Atlanta	0.0	0.0	94.5
Giffin	39.8	39.8	54.7
Forsyth	29.5	69.3	25.2
Macon	25.2	94.5	0.0

Macon-Jacksonville, 254.8 Miles.

	Miles to	Total Miles	Out Return
Macon	0.0	0.0	254.8
Perry	28.2	28.2	226.6
Fitzgerald	67.5	95.7	159.1
Waycross	78.6	174.3	80.5
Jacksonville	80.5	254.8	0.0

Jacksonville-Miami, 381 Miles.

	Miles to	Total Miles	Out Return
Jacksonville	0.0	0.0	381.0
St. Augustine	39.8	39.8	341.2
Hastings	18.5	58.3	322.7
Daytona	54.9	113.2	267.8
Titusville	48.7	161.9	219.1
Melbourne	41.4	203.3	177.7
Fort Pierce	48.8	252.1	128.9
West Palm Beach	59.8	311.9	69.1
Fort Lauderdale	43.0	354.0	26.1
Miami	26.1	381.0	0.0



Dixie Highway Ends Amid Banks of Palms and Profuse Foliage.

MISSISSIPPI TO THE SEA.

From Memphis to Los Angeles Through Southwestern States and Along Mexican-United States Border Line.

ONE of the most enjoyable southern tours, especially as a late fall or winter trip, is an extension of the New York to New Orleans route to the Pacific coast. During those seasons the roads are likely to be in better condition than the routes further north. The south has been developing a great number of motorists, some of whom may desire to make a transcontinental trip through their own section of the country.

Very fair highways already connect its principal cities and the trip can be made to the Pacific through the country south of the Mason and Dixon line without hardship. From New York to

Big Spring, Fort Stockton, Alpine, Sierra Blanca and El Paso, Tex.; Deming, N. M.; Willcox, Tucson, Phoenix and Yuma, Ariz.; El Centro, San Diego and Los Angeles, Cal. Eighteen Days, 2423.7 Miles.

Memphis-Clarendon, 93.2 Miles.

	Miles to	Total Miles	Out Return
Memphis	0.0	0.0	93.2
Ferry to Mound City, Ark.			
Marion	6.0	6.0	87.2
Madison	37.5	43.5	49.7
Forrest City	4.5	48.0	45.2
Beck's Spur	4.0	52.0	41.2
Goodwin	10.5	62.5	30.7
Wheatley	5.2	67.7	25.5

Prescott	5.2	84.0	54.3
Emmet	8.5	92.5	45.8
Hope	9.1	101.6	36.7
Fulton	14.2	115.8	22.5
Homan	7.8	123.6	14.7
Mandeville	8.3	131.9	6.4
Texarkana	6.4	138.3	0.0

Texarkana-Dallas, 217 Miles.

	Miles to	Total Miles	Out Return
Texarkana	0.0	0.0	217.0
Leary, Tex.	10.4	10.4	206.6
Hooks	4.6	15.0	202.0
New Boston	7.3	22.3	194.7
Boston	1.3	23.6	193.4
De Kalb	12.7	36.3	180.7
Annona	19.2	55.5	161.5
Clarksville	9.4	64.9	152.1
Detroit	13.5	78.4	138.6
Blossom	9.0	87.4	129.6
Paris	9.7	97.1	119.9
Brookston	10.2	107.3	109.7
Hightown	2.7	110.0	107.0
Petty	3.6	113.6	103.4



Highway Into the Mountains Through the Western States.

Washington the route follows that of the National Old Trails road. From Washington it leads to Atlanta over the Washington-New Orleans route, and from Atlanta to Memphis on the route from Atlanta to Louisville.

From Memphis the route leads in a southwesterly direction across Arkansas, through Forest City, Clarendon, Hot Springs and Texarkana, Dallas, Abilene, Big Springs, Ft. Stockton and along the United States and Mexican border line through Sierra Blanca, El Paso, Deming, Tucson, Phoenix and Yuma to San Diego and Los Angeles.

Brinkley	10.0	77.7	15.5
Clarendon	15.5	93.2	0.0

Clarendon-Hot Springs, 139.6 Miles.

	Miles to	Total Miles	Out Return
Clarendon	0.0	0.0	139.6
Ferry to Roe.			
Stuttgart	21.4	21.4	118.2
Hazen	20.5	41.9	97.7
Carlisle	9.0	50.9	88.7
Lonoka	11.1	62.0	77.6
Argenta	23.2	85.2	54.4
Little Rock	1.1	86.3	53.3
Collegeville	15.2	101.5	38.1
Benton	8.2	109.7	29.9
Fairplay Crossing	6.2	115.9	23.7
Fuller Crossing	1.5	117.4	22.2
Lonsdale	6.8	124.2	15.4
Hot Springs	15.4	139.6	0.0

Hot Springs-Texarkana, 138.3 Miles.

	Miles to	Total Miles	Out Return
Hot Springs	0.0	0.0	138.3
Lawrence	6.4	6.4	131.9
Social Hill	18.9	25.3	113.0
Friendship	9.6	34.9	103.4
Arkadelphia	9.3	44.2	94.1
Dobyville	15.9	60.1	78.2
Okolona	6.0	66.1	72.2
Boughton	12.7	78.8	59.5

Honey Grove	6.7	120.3	96.7
Windom	5.4	125.7	91.3
Dodd City	4.5	130.2	86.8
Bonham	6.3	136.5	80.5
Whitewright	15.4	151.9	65.1
Pilot Grove	6.4	158.3	58.7
Sedalia	5.8	164.1	52.9
Anna	7.2	171.3	45.7
Mellasa	4.7	176.0	41.0
McKinney	7.7	183.7	33.3
Plano	14.1	197.8	19.2
Richardson	6.0	203.8	13.2
Vickery	6.1	209.9	7.1
Dallas	7.1	217.0	0.0

Dallas-Abilene, 207.1 Miles.

	Miles to	Total Miles	Out Return
Dallas	0.0	0.0	207.1
Grand Prairie	13.1	13.1	194.0
Arlington	6.5	19.6	187.5
Handley	6.5	26.1	181.0
Fort Worth	5.5	31.6	175.5
Ben Brook	10.3	41.9	165.2
Aledo	9.9	51.8	155.3
Annetta	6.3	58.1	149.0
Weatherford	7.6	65.7	141.4
Mineral Wells	22.3	88.0	119.1
Palo Pinto	12.1	100.1	107.0
Caddo	26.6	126.7	80.4
Breckenridge	15.4	142.1	65.0
Albany	24.9	167.0	40.1
Hambly	33.3	200.3	6.8
Abilene	6.8	207.1	0.0

ITINERARY.

Memphis to Los Angeles.

Night Stops—Memphis, Tenn.; Clarendon, Hot Springs and Texarkana, Ark.; Dallas, Abilene,



Vast Expanses of Farming Prairie Land Under Irrigation.

Abilene-Big Spring, 110.6 Miles.

	Miles to	Total Miles	Out Return
Abilene	6.0	6.0	110.6
Tye Station	7.9	7.9	102.7
Merkel	8.3	16.3	94.4
Trent	6.5	22.7	87.9
Sweetwater	18.7	41.4	69.2
Roscoe	8.8	50.3	60.4
Lorraine	10.9	61.1	49.5
Colorado	8.4	70.5	40.1
Westbrook	16.3	86.8	23.8
Iatan	9.6	96.4	29.3
Conahon	8.4	104.8	11.8
Big Spring	11.8	116.6	0.0

Big Spring-Fort Stockton, 177.7 Miles.

	Miles to	Total Miles	Out Return
Big Spring	0.0	0.0	177.7
Stanton	24.2	24.2	153.5
Midland	19.4	43.6	134.1
Warfield	10.4	54.0	123.7
Odessa	12.0	66.0	111.7
Y Ranch	31.4	97.4	80.3
Acoc Range	12.2	109.6	68.1
Edwards Ranch	7.2	116.8	60.9
Grand Falls	28.0	144.8	32.9
Fort Stockton	32.9	177.7	0.0

Fort Stockton-Alpine, 90.7 Miles.

	Miles to	Total Miles	Out Return
Fort Stockton	0.0	0.0	90.7
Marathon	58.3	58.3	32.4
Alpine	32.4	90.7	0.0

Alpine-Sierra Blanca, 131.6 Miles.

	Miles to	Total Miles	Out Return
Alpine	0.0	0.0	131.6
Marfa	26.4	26.4	105.2
Aragon	10.9	37.3	94.3
Valentine	24.7	62.0	69.6
Wendell	8.7	70.7	60.9
Chispa	7.3	78.0	53.6
Lobo	12.0	90.0	41.6
Dalberg	13.5	103.5	28.1
Chocor	4.7	108.2	23.4
Torbert	4.4	112.6	19.0
Grayton	9.1	121.7	9.9
Sierra Blanca	9.9	131.6	0.0

Sierra Blanca-El Paso, 92.4 Miles.

	Miles to	Total Miles	Out Return
Sierra Blanca	0.0	0.0	92.4
Etholen	4.3	4.3	88.1
Lasca	5.4	9.7	82.7
Finley	13.1	22.8	69.6
Fort Hancock	15.7	38.5	53.9
Polvo	13.8	52.3	40.1
Fubana	10.8	63.1	29.3
El Paso	29.3	92.4	0.0

El Paso-Deming, 103.2 Miles.

	Miles to	Total Miles	Out Return
El Paso	0.0	0.0	103.2
Montoya, N. M.	9.9	9.9	93.3
Canutillo	2.8	12.7	96.5
La Tuna	5.8	18.5	84.7
Berino	5.3	23.8	79.4
Mesquite	8.3	32.0	71.3
San Miguel	3.1	35.1	68.1
Afton	14.4	49.5	53.7
Kensin	3.8	53.3	58.9
Pronto	5.2	57.5	45.7
Aden	4.3	61.7	41.5
Cambray	12.9	74.6	28.6
Deming	28.6	103.2	0.0

Deming-Willcox, 137.1 Miles.

	Miles to	Total Miles	Out Return
Deming	0.0	0.0	137.1
Tunis	8.4	8.4	128.7
Gage	11.2	19.6	117.5
Willia	9.0	28.6	108.5
Ladin	5.7	34.3	102.8
Separ	5.8	40.1	97.0
Lisbon	9.2	49.3	87.8
Lordsburg	10.8	60.1	77.0
Stein's Pass	20.3	80.4	56.7
Vanar, Ariz.	7.5	87.9	49.2
San Simon	7.9	95.8	41.3
Holt	12.1	107.9	29.2
Bowie	4.4	112.3	24.8
Cholla	4.2	116.5	20.6
Lusena	3.4	119.9	17.2
Glade	9.3	129.2	7.9
Willcox	7.9	137.1	0.0

Willcox-Tucson, 89.2 Miles.

	Miles to	Total Miles	Out Return
Willcox	0.0	0.0	89.2
Cochise	11.1	11.1	78.1
Dragoon	9.8	20.9	68.3
Benson	18.7	39.6	49.6
Mescal	10.4	50.0	39.2
Vall	19.1	69.1	26.1
Esmond	4.5	73.6	15.6
Wilmet	8.5	82.1	7.1
Tucson	7.1	89.2	0.0

Tucson-Phoenix, 126.8 Miles.

	Miles to	Total Miles	Out Return
Tucson	0.0	0.0	126.8
Rillito	18.2	18.2	108.6
Red Rock	16.2	34.4	92.4
Florence	34.5	68.9	57.9
Mesa	42.1	111.0	15.8
Tempe	7.0	118.0	8.8
Phoenix	8.8	126.8	0.0

Phoenix-Yuma, 206.9 Miles.

	Miles to	Total Miles	Out Return
Phoenix	0.0	0.0	206.9
Cashion	12.0	12.0	194.9
Coldwater	2.5	14.5	192.4
Liberty	12.0	26.5	180.4
Buckeye	6.0	32.5	174.4
Palo Verde	6.7	39.2	167.7
Arlington	11.0	50.2	156.7
Agua Caliente	42.7	92.9	114.0

Palomas	10.5	103.4	103.5
Castle Dome	59.3	162.7	44.2
Gila City	25.5	188.2	18.7
Done	6.5	188.7	18.2
Yuma	18.2	206.9	0.0

Yuma-El Centro, 102 Miles.

	Miles to	Total Miles	Out Return
Yuma	0.0	0.0	102.0
Ogilvy, Cal.	29.5	29.5	72.5
Drylyn	7.3	36.8	65.2
Glamis	11.2	48.0	54.0
Mammoth	13.5	61.5	40.5
Brawley	27.0	88.5	13.5
Imperial	9.5	98.0	4.0
El Centro	4.0	102.0	0.0

El Centro-San Diego, 124.2 Miles.

	Miles to	Total Miles	Out Return
El Centro	0.0	0.0	124.2
Devil's Canyon	46.0	46.0	78.2
El Campo	25.5	71.5	52.7
Potrero	9.5	81.0	43.2
Duisura	13.2	94.2	30.0
Jamul	8.5	102.7	21.5
Oakdale	1.7	104.4	19.8
Spring Valley	7.3	111.7	12.5
San Diego	12.5	124.2	0.0

ITINERARY.**WASHINGTON-NEW ORLEANS.**

Night Stops—Richmond, Va.; Henderson, Winston-Salem and Charlotte, N. C.; Greenville, S. C.; Atlanta, Ga.; Montgomery, Thomaston and Mobile, Ala.; Gulfport, Miss.; New Orleans, La. Eleven Days, 1425.8 Miles.

Washington-Richmond, 121.6 Miles.

	Miles to	Total Miles	Out Return
Washington	0.0	0.0	121.6
Alexandria, Va.	7.2	7.2	114.4
Lorton	12.2	19.4	102.2
Ocoquan	3.5	22.9	98.7
Dumfries	10.7	33.6	88.0
Stafford	16.4	50.0	71.6
Fredericksburg	9.4	59.4	62.2
Massaponax	9.4	68.8	52.8
Castelman's Mill	5.9	74.7	46.9
Golansville	13.2	87.9	33.7
Ashland	16.4	104.3	17.3
Richmond	17.3	121.6	0.0

Richmond-Henderson, 145.9 Miles.

	Miles to	Total Miles	Out Return
Richmond	0.0	0.0	145.9
Petersburg	22.7	22.7	123.2

Carson	14.9	37.8	105.3
Lee	14.0	51.6	94.3
Jarrat	5.8	57.4	88.5
Emporia	9.9	67.3	78.6
Brink	7.7	75.0	76.9
Barley	6.9	81.9	64.0
Roanoke Rapids,			
N. C.	11.8	93.7	53.3
Holden	2.4	93.1	49.8
Thelma	6.7	102.8	43.1
King's Cross			
Roads	1.1	103.9	43.0
Sunlight	1.3	105.3	46.7
Littleton	5.3	110.5	35.4
Vaughan	5.8	116.3	29.6
Macon	5.4	121.7	24.3
Warrenton	5.7	127.4	18.5
Afton	4.8	132.2	13.7
Henderson	13.7	145.9	0.0

Henderson — Winston-Salem,
148.5 Miles.

	Miles to	Total Miles	Out Return
Henderson	0.0	0.0	148.5
Oxford	11.7	11.7	136.8
Providence	5.7	17.4	131.1
Tallyho	5.3	22.6	125.9
Stem	1.3	23.9	124.6
Knapp of Reeds	4.7	28.6	119.9
Bragtown	11.6	40.2	108.3
Durham	3.3	43.5	105.0
Chapel Hill	12.1	55.6	92.9
White Cross	9.0	64.6	83.9
Saxapahaw	9.7	74.3	74.2
Graham	12.1	86.4	62.1
Burlington	2.9	89.3	59.2
Gibsonville	6.7	96.0	52.5
Whitsett Cross			
Roads	2.7	98.7	49.8
Greensboro	13.6	112.3	36.2
Gulldford	5.7	118.0	30.5
Summerfield	6.7	124.7	23.8
Kernersville	11.7	136.4	12.1
Centerville	9.8	146.2	2.3
Winston-Salem	2.3	148.5	0.0

Winston-Salem — Charlotte,
81.5 Miles.

	Miles to	Total Miles	Out Return
Winston-Salem	0.0	0.0	81.5
Midway	13.7	13.7	67.8
Brinkleys	3.2	16.9	64.6
Lexington	7.0	23.9	57.6
Spencer	14.6	38.5	43.0
Salisbury	2.8	41.3	40.2
China Grove	2.8	44.1	37.4
Landis	2.4	46.5	35.0
Kanapolis	4.7	51.2	30.3
Concord	7.9	59.1	22.4
Pharr's Mill	6.2	65.3	16.2
Newell	8.4	73.7	7.8
Charlotte	7.8	81.5	0.0

Charlotte-Greenville, 117.3
Miles.

	Miles to	Total Miles	Out Return
Charlotte	0.0	0.0	117.3
Sloane's Ferry	10.9	10.9	106.4
Belmont	1.7	12.6	104.7

Lowell	4.7	17.3	100.0
Gastonia	5.5	22.8	94.3
Bessemer City	6.8	29.6	87.7
King's Mountain	6.0	35.6	81.7
Grover	8.1	43.7	73.6
Blacksburg, S. C.	6.3	50.0	67.3
Gaffney	9.1	59.1	58.3
Cowpens	11.9	71.0	46.3
Converse	3.1	74.1	43.2
Spartanburg	6.4	80.5	36.8
Fair Forest	5.3	85.8	31.5
Tucapau	6.5	92.3	25.0
Duncan	4.6	96.9	20.4
Greer	5.1	102.0	15.3
Taylors	5.6	107.6	9.7
Greenville	9.7	117.3	0.0

Greenville-Atlanta, 170.7
Miles.

	Miles to	Total Miles	Out Return
Greenville	0.0	0.0	170.7
Oak Grove	9.4	9.4	161.3
Piedmont	2.2	11.6	159.1
Anderson	21.0	32.6	138.1
Fair Play	23.0	55.6	115.1
Lavonia, Ga.	10.2	65.8	104.9
Bowersville	5.6	71.4	99.3
Canon	2.4	73.8	96.9
Royston	4.5	78.3	92.4
Franklin Springs	2.2	80.5	90.2
Pocataligo	12.7	93.2	77.5
Commerce	12.5	105.7	65.0
Apple Valley	4.5	110.2	60.5
Jefferson	4.9	115.1	55.6
Winder	3.6	118.7	52.0
Carl	6.0	124.7	46.0
Lawrenceville	12.3	137.0	33.7
Snellville	7.4	144.4	26.3
Stone Mountain	10.4	154.8	15.9
Clarkson	5.0	159.8	10.9
Scottdale	2.1	161.9	8.8
Ingleside	1.1	163.0	7.7
Dacula	1.6	164.6	6.1
Kirkwood	1.9	166.5	4.2
Atlanta	4.2	170.7	0.0

Atlanta-Montgomery, 187.7
Miles.

	Miles to	Total Miles	Out Return
Atlanta	0.0	0.0	187.7
College Park	8.9	8.9	178.8
Red Oak	3.7	12.6	175.1
Fairburn	7.1	19.7	168.0
Palmetta	6.3	26.0	161.7
McCullom	5.4	31.4	156.3
Madras	2.9	34.3	153.4
Newman	6.7	41.0	146.7
Moreland	7.5	48.5	139.3
St. Charles	1.5	50.0	137.7
Grantville	4.4	54.4	133.3
La Grange	20.5	74.9	112.8
West Point	15.3	90.2	97.5
Langdale	4.9	95.1	92.6
Beulah	10.5	105.6	82.1
Opelika	14.4	120.0	67.7
Tuskegee	26.5	146.5	41.2
La Place	12.3	158.8	28.9
Shorter	5.1	163.9	23.8
Meigs	11.3	175.2	12.5
Montgomery	12.5	187.7	0.0

Montgomery-Thomasville,
127.2 Miles.

	Miles to	Total Miles	Out Return
Montgomery	0.0	0.0	127.2
Prattville	13.8	13.8	113.4
Autaugaville	11.7	25.5	101.7
Mulberry	8.7	34.2	93.0
Statesville	3.5	37.7	89.5
Burnsville	3.5	41.2	86.0
Selma	9.0	50.2	77.0
Beloit	12.1	62.3	64.9
Hazen	3.1	65.4	61.8
Orrville	3.9	69.3	57.9
Martins	3.2	72.5	54.7
Safford	4.2	76.7	50.5
Central Mills	4.8	81.5	45.7
Corley	2.5	84.0	43.2
Consul	4.5	88.5	38.7
Thomaston	4.7	93.2	34.0
Octagon	10.5	103.7	23.5
Shiloh	6.2	109.9	17.3
Clay Hill	8.2	118.1	9.1
Thomasville	9.1	127.2	0.0

Thomasville-Mobile, 106.9
Miles.

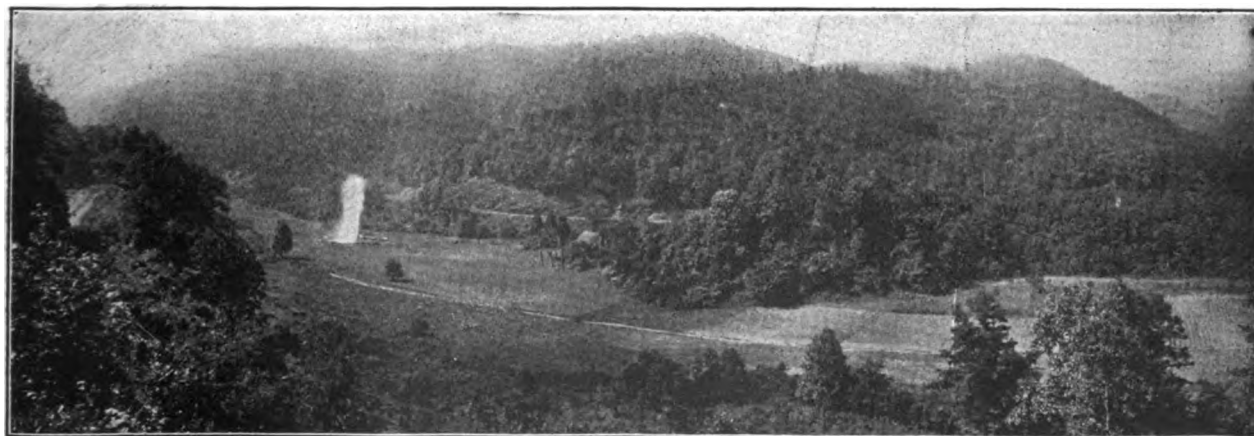
	Miles to	Total Miles	Out Return
Thomasville	0.0	0.0	106.9
Grove Hill	16.4	16.4	90.5
Jackson	16.9	33.3	73.6
Leroy	6.7	40.0	66.9
McIntosh	22.7	62.7	44.2
Malcolm	6.8	69.5	37.4
Calvert	3.6	73.1	33.8
Mount Vernon	5.2	78.3	28.6
Chastang	3.5	81.8	25.1
Alex	8.4	90.2	16.7
Creola	2.1	92.3	14.6
Pennsylvania	1.2	93.5	13.4
Saraland	3.8	97.3	9.6
Plateau	6.4	103.7	3.2
Mobile	3.2	106.9	0.0

Mobile-Gulfport, 84 Miles.

	Miles to	Total Miles	Out Return
Mobile	0.0	0.0	84.0
Marta, Ala.	4.0	4.0	80.0
Orange Grove,			
Miss.	30.0	34.0	50.0
Pascagoula	5.8	39.8	44.2
W. Pascagoula	1.9	41.7	42.3
Ocean Springs	10.6	52.3	31.7
Biloxi	18.7	71.0	13.0
Mississippi City	9.6	80.6	3.4
Gulfport	3.4	84.0	0.0

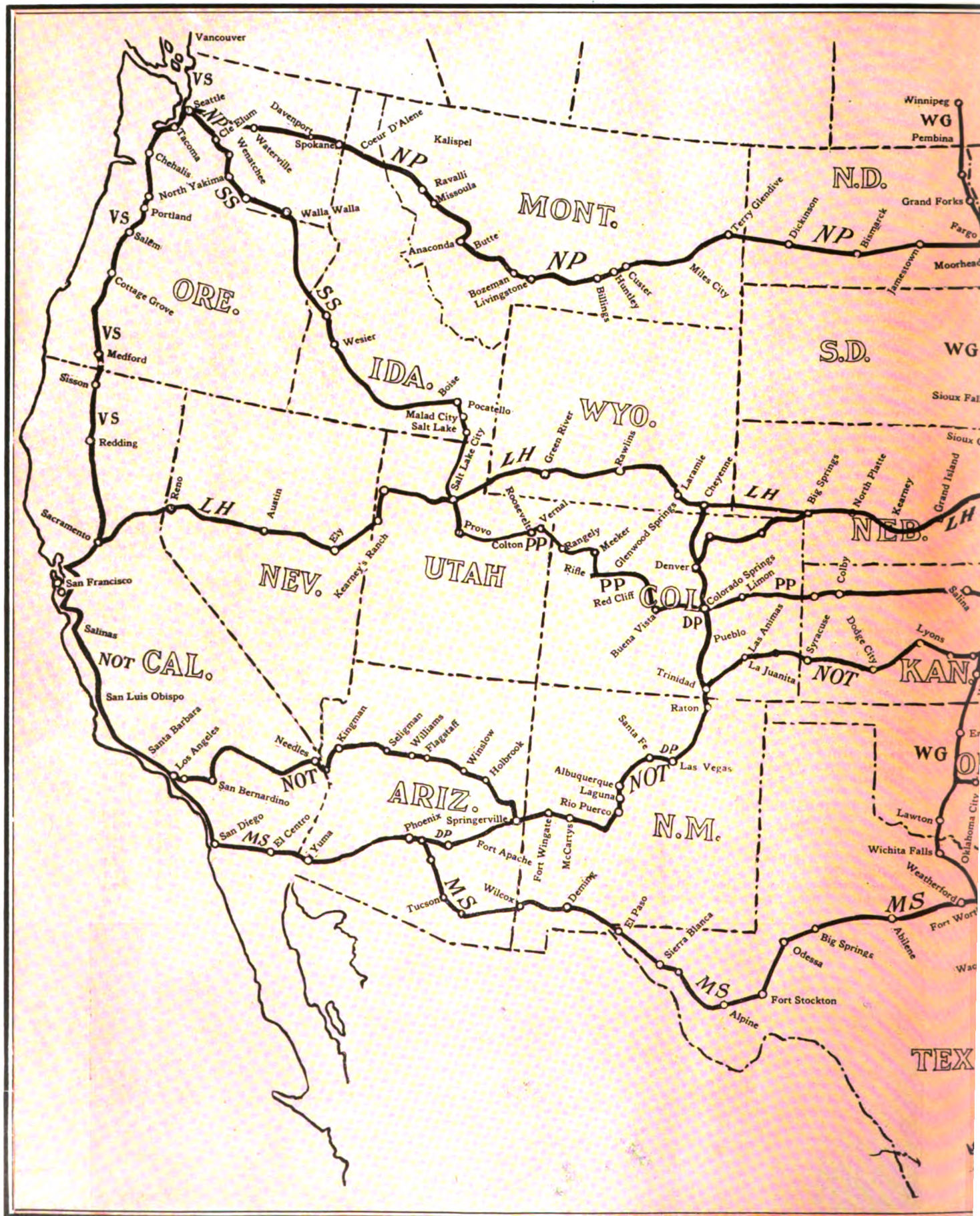
Gulfport-New Orleans, 134.5
Miles.

	Miles to	Total Miles	Out Return
Gulfport	0.0	0.0	134.5
Long Beach	3.1	3.1	131.4
Pass Christian	4.9	8.0	126.5
Cuevas	2.6	10.6	123.9
Vidalia	11.5	22.1	112.4
Standard	5.7	27.8	106.7
Poplarville	25.7	53.5	81.0
Bogalusa	35.2	88.7	45.8
Claiborne	28.1	116.8	17.7
Covington	0.6	117.4	17.1
Mandeville	10.0	127.4	7.1
New Orleans	7.1	134.5	0.0

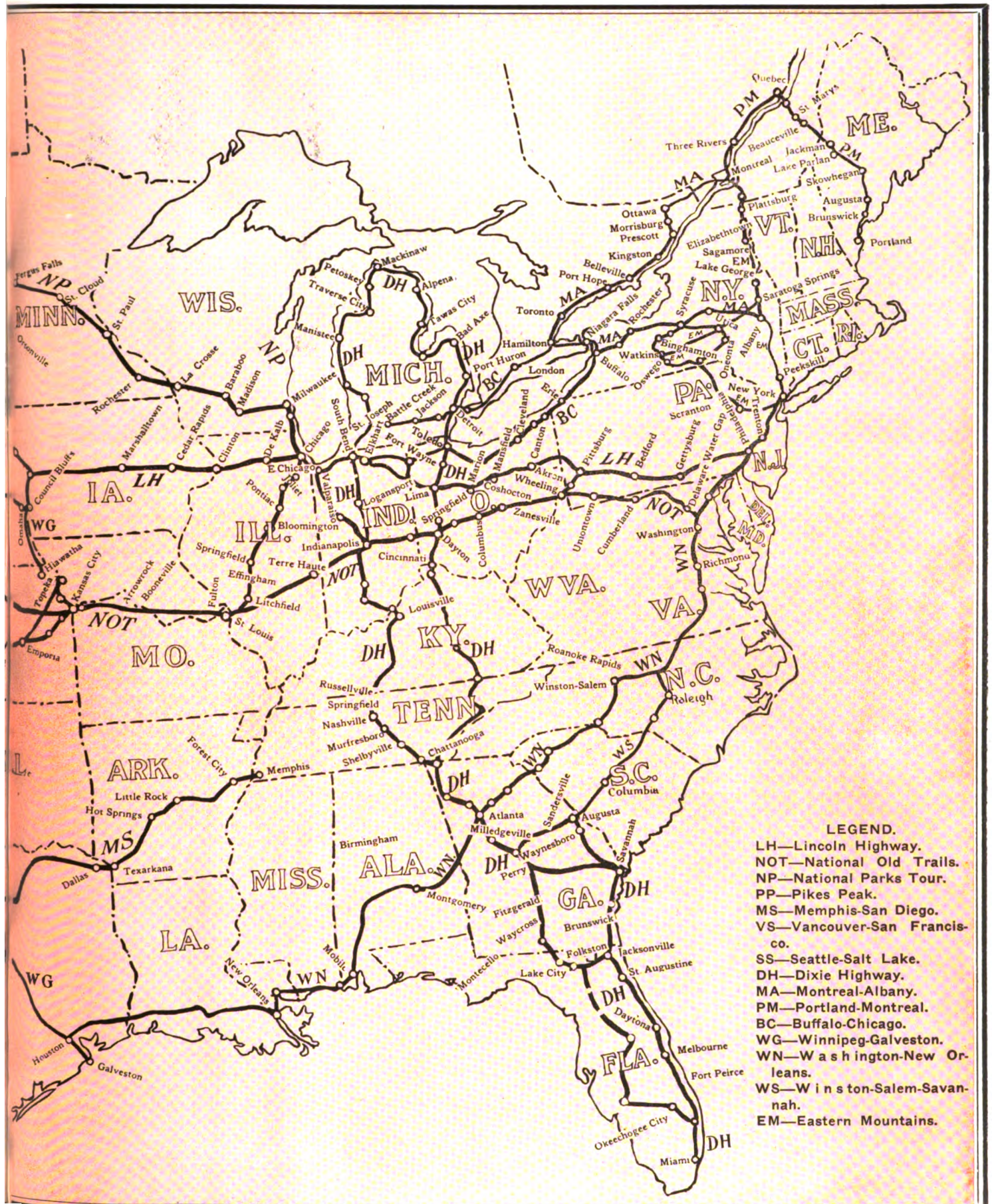


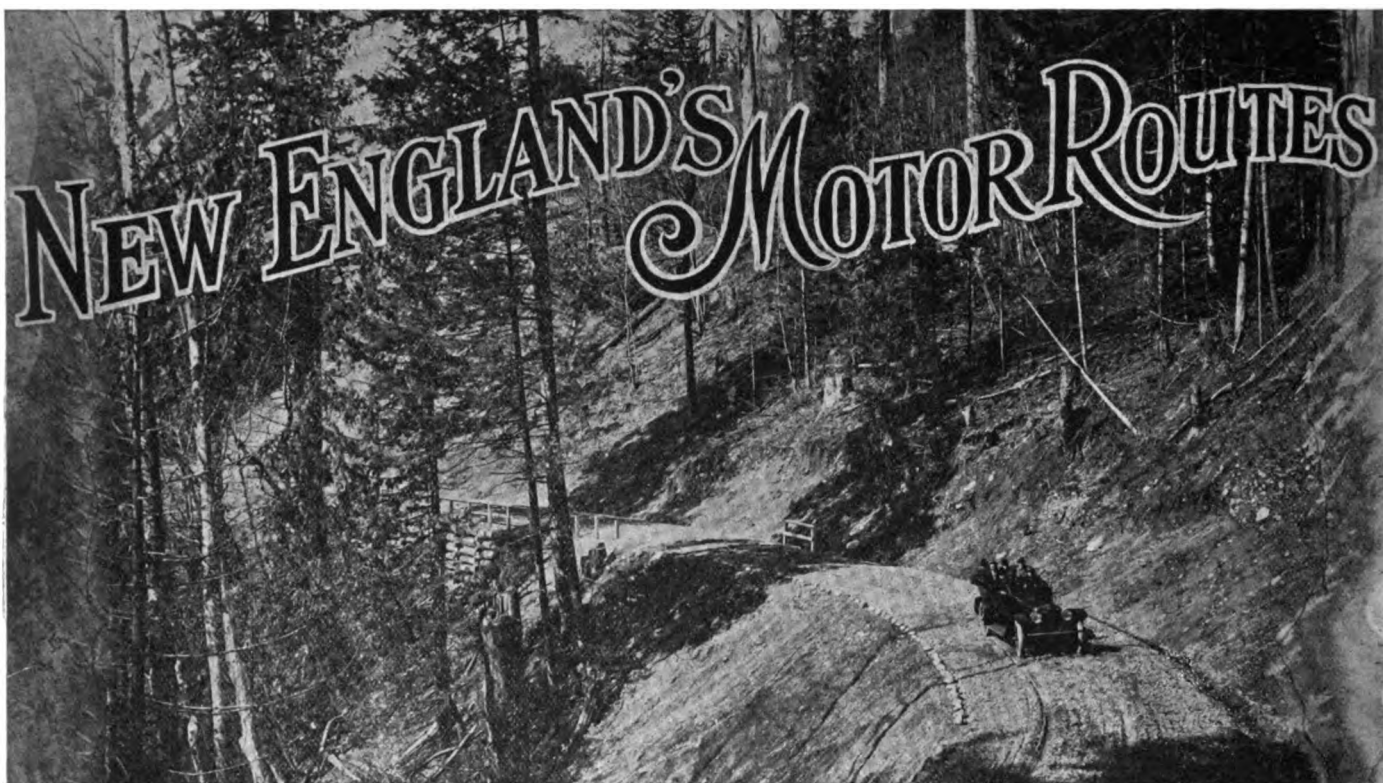
Andrews Geyser in the Mountains Near Road to Asheville, N. C.—A Favorite Winter Resort.

The Automobile Journal's Transcontinental and



Inter-State Touring Map of the United States.





Touring Through New England.

TOURING in New England commenced with the production of the first reliable automobile and this section of the country has held its supremacy as an ideal touring country ever since. Being densely populated, New England not only affords the best system of roads in America, but has innumerable pleasure resorts and fine hotel service throughout, all of which factors appeal strongly to the motorist. Historically, it is the Mecca of all those who are interested in the country's origin and development as the nation's greatest political, military, educational and industrial movements have been closely identified with this section. In fact, these six comparatively small states contain America's greatest educational institutions, and are the playgrounds for its richest citizens. The entire tour as mapped out in the accompanying itinerary, can be covered in about 11 days from New York City, although there are so many points of interest along the route that many more days can be spent with profit in sightseeing.

The tour leaves New York over the Old Boston Post road, along Long Island sound, passing through many interesting old towns with historical associations. These towns are now largely residential suburbs of New York City and contain many fine homes and beautiful estates. At Rye, N. Y., is the Haviland Inn, which has been operated since colonial times.

In Greenwich, Conn., the first town in New England passed by this route, is the home of General

Putnam on East Putnam avenue. Some of the original stone steps down which the general is said to have ridden his horse to escape the British under Tryon are still to be seen. Millbank, once the home of Boss Tweed, is a fine country estate. Darien was the scene of the capture of the Rev. Moses Mather and his congregation by the British in 1781. His little brick church still stands by the old post road. Norwalk was burned by the British during the revolution, but many quaint old houses that survived are still to be seen.

Bridgeport is a thoroughly industrial city, the largest in volume of manufactures in the State of Connecticut.

After passing Stratford the road turns north through the picturesque Housatonic valley toward the Berkshires. Ansonia is a manufacturing town given over to brass and iron foundries, and Waterbury is chiefly known in the world of commerce for the clocks and watches it has produced for many, many years.

From Waterbury the route follows the Naugatuck valley, which gradually becomes narrower to Thomaston, named after Seth Thomas, the owner of the great clock factory, which is the town's chief industry. Winsted lies at the junction of the Mad and Still rivers. Haystack mountain is passed just before the road enters Canaan. Here the Housatonic itself is reached and the road passes the marble quarries at Ashley Falls and Sheffield, and

enters the Berkshires, a very beautiful district of hills, mountains and rivers. Lenox, the night stop, is in the heart of the Berkshires.

Out of Lenox the next morning the tourist comes to Pittsfield, the metropolis of the Berkshires and the very heart of that interesting section.

From Pittsfield the road continues through Lanesboro and South Williamstown to Williams-town, the site of Williams college.

Near Williamstown the road passes Mount Graylock, the highest peak in Massachusetts. Some of the wildest scenery in the State of Massachusetts is to be found in this mountainous locality.

At Pownal, Vt., the road goes up a steep rise and then descends into Bennington.

Manchester has long been one of the finest summer resorts in the country. The golf links thereabout are especially fine and the town is the summer golf capital. Many important national contests are held on its splendid links.

Crossing the Connecticut river on the fourth day the road goes through the Peru mountain pass and proceeds through many pleasant villages to Sunapee Lake, N. H., 1104 feet above the sea in the hills of Sullivan and Merrimac counties.

The next day's run takes the tourist to the White mountains by way of Plymouth on the Pemigewasset river. From here Mt. Prospect, 2072 feet high, is clearly visible to the northeast.



Coast Line at Kennebunkport, Me.

The route goes through West Campton. From here Mount Welch is a prominent object in the landscape. Mt. Prospect can still be seen; the Sandwich mountains are on the east and Livermore Falls are in the vicinity. The Devil's den is a deep cave at Campton Hollow. The Franconia mountains are plainly visible from Durgin's hill.

The Franconia notch, through which the tourist goes, is five miles long and less than a half mile wide, and is the western fringe of the Franconia mountains. The small district about is remarkably rich in scenic interest.

The next day's run can be accomplished in little more than an hour, allowing the tourist plenty of time to explore more points in this remarkable country. It leads past the Twin Mountains on the heights above the Ammonoosuc river to Bretton Woods.

From Bretton Woods the tourist goes through Crawford notch to Glen station and Intervale. Glen station is in full view of all the presidential peaks and is near the Peabody river. The road

goes over Tug of War hill and passes the Willey house, which was buried with its inmates in 1826 by an avalanche.

It then runs along the valley of the Saco river, through the beautiful "Intervales" of the great ravine. At Freyburg, Me., "Jockey Cap" is passed and near Bridgeton there is a run along the charming shores of Long lake. The tourist is now out of the mountains and into the rolling beautiful country of farms and lakes. The approach to Poland Spring, the night stop, is made through country dotted with lakes and ponds. Poland Spring is nationally famous for the purity of its water.

From Poland Spring the route goes through Portland and Portsmouth to Newcastle, just outside of that city.

From Portland the road follows a route a few miles inland to avoid the many bays that dent the coast. It is only a few miles, however, from the maritime towns and summer resorts which abound on the coast all the way to Portsmouth. This is the only seaport in the State of New Hamp-

shire and before 1807 it was the capital of the state. In the colonial days the place was heavily fortified and equipped with batteries of many guns. It had stout stockades, which in the main protected it from marauding Indians.

Newcastle, about two miles from Portsmouth, was originally a fishing village.

From Newcastle the route goes down the coast through some of the oldest and most highly developed New England towns to Boston.

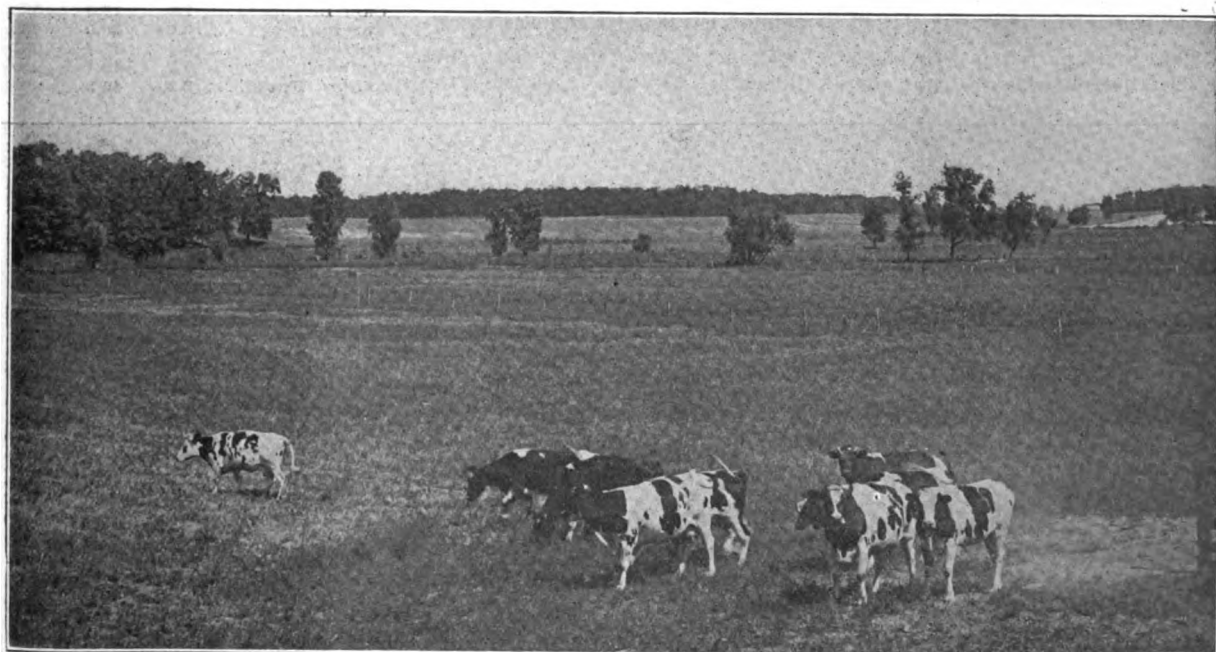
Newburyport is a very old maritime city and many ships were built there in the days of the great American merchant marine.

Salem, the oldest city of the Massachusetts colony, is situated on two inlets of the sea. This was once a centre of the East India trade and the home of a group of powerful shipping masters. The Roger Williams house still stands in the town. It was the scene of several trials during the witchcraft delusion. Outside the town is Gallows hill, where the 19 people were put to death because they had been found to be bewitched.

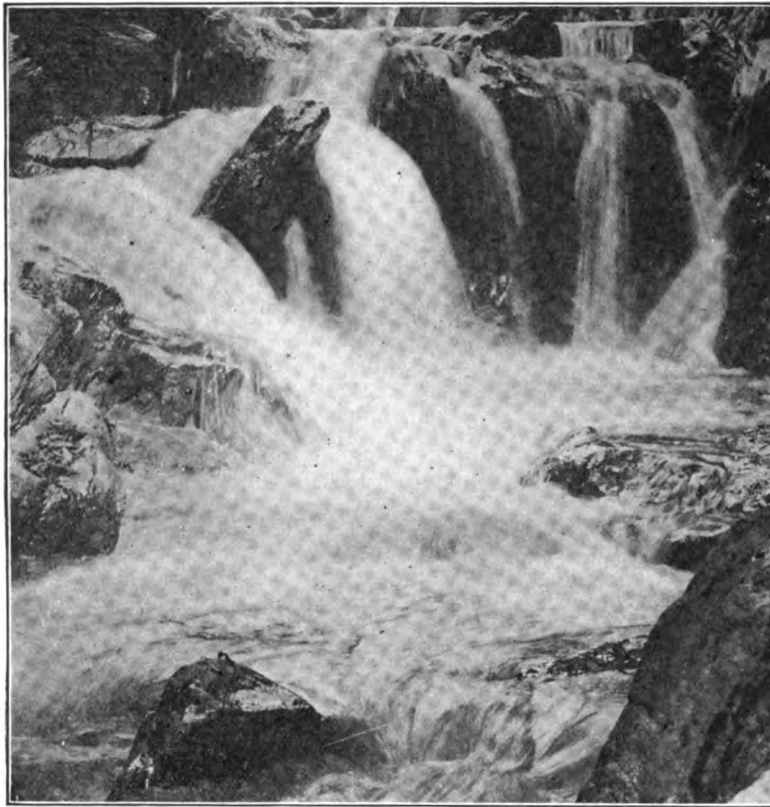
Lynn is a manufacturing city with a fine harbor on Massachusetts bay. It was founded in 1629 and named for Lynn Regis, the home of its first pastor in England. It is now a great shoe manufacturing city. The trade there dates back to 1750.

Swampscott, not far from Lynn, is famous as a watering place for the elite of Boston and the surrounding towns.

Boston has hundreds of points of great interest, too numerous and too well known to be taken up in detail. Among them are Bunker Hill monument, Faneuil



Pasture Scene in New England's Fertile Fields, Where Dairying Is a Leading Industry.



Bolton Falls on Little River, Vermont.

hall, State house, Shaw monument, Old South Meeting house, Old North church, Old State house, King's chapel, Park Street church, St. Paul's church, Boston Athanaeum, Paul Revere's house, Museum Boston Society of Natural History, Public library, Harvard university, the suburb of Concord, the water front and so on.

From Boston the road goes south through Providence and skirting the west shore of Narragansett bay, reaches the sound and goes along the shore to New London.

This route as far as Providence is described elsewhere in the tour-

ing number. Leaving Providence the tourist sees numerous interesting and pretty shore towns on the way to Narragansett Pier, which has long been a famous American watering place. The pier itself was destroyed some years ago and has not since been rebuilt. There are fine roads near here and excellent bathing in a light surf. Commodore Oliver Hazard Perry, whose brilliant victory in the war of 1812 over the British fleet at Put-in-Bay, Ohio, in Lake Erie, is much celebrated, was born in Narragansett. Mystic is near Mystic Island, long a quiet, but popular summer resort.

From there the road goes through Groton, across the

Thames river to New London.

The final day's run takes the tourist through New Haven, the seat of Yale university, and Bridgeport to New York. Chief Justice Waite was born in Lyme. Old Saybrook is not far from Saybrook Point. A fort was erected there in colonial times to protect the settlement, which was established by the Plymouth colony.

ITINERARY. NEW ENGLAND TOUR.

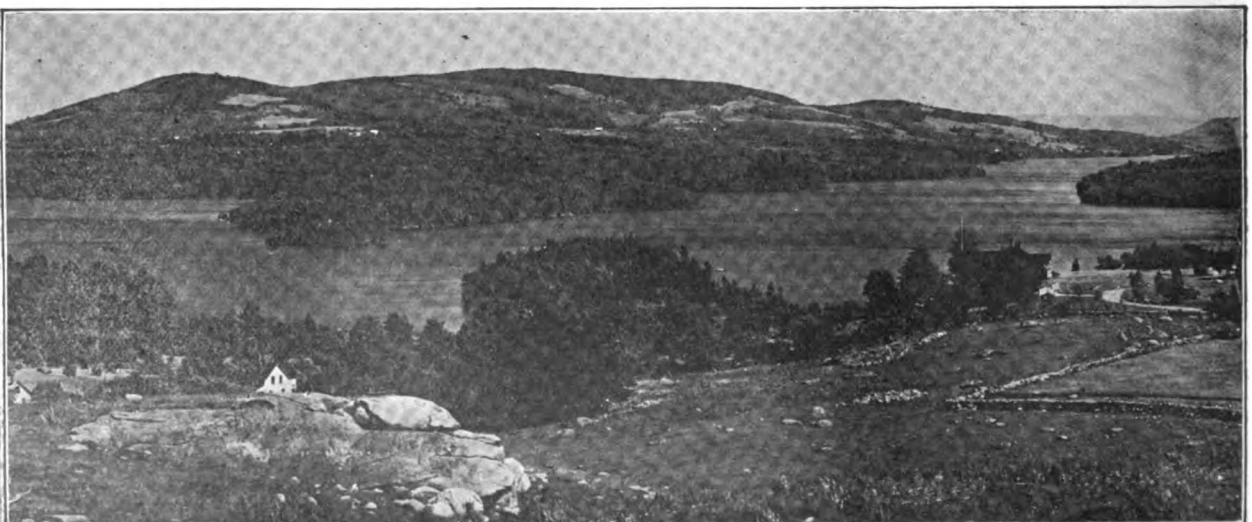
Night Stops—New York, Waterbury, Conn.; Lenox, Mass.; Manchester, Vt.; Sunapee Lake, Profile House, Bretton Woods, N. H.; Poland Springs, Me.; New-castle, N. H.; Boston, Mass.; New London, Conn.; New York City. Eleven Days, 899.9 Miles.

New York-Waterbury, 89 Miles.

	Miles to	Total Miles
	Out	Return
New York	0.0	0.0
New Rochelle	17.7	17.7
Mamaroneck	3.4	21.1
Rye	3.7	24.8
Port Chester	1.7	26.5
Greenwich	3.1	29.6
Stamford	5.1	34.7
Darien	4.5	39.2
Norwalk	4.2	43.4
Westport	3.3	46.7
Southport	4.3	51.0
Bridgeport	6.2	57.2
Stratford	3.7	60.9
Shelton	9.8	70.7
Derby	0.3	71.0
Seymour	5.6	76.6
Naugatuck	7.3	83.9
Waterbury	5.1	89.0

Waterbury-Lenox, 69.1 Miles.

	Miles to	Total Miles
	Out	Return
Waterbury	0.0	0.0
Waterville	2.8	2.8
Thomaston	7.0	9.8
East Litchfield	7.2	17.0
Torrington	3.0	20.0
Norfolk	15.4	35.4
Canaan	7.7	43.1
Ashley Falls	2.2	45.3



Lake Sunapee, N. H., a Typical New England Environment, Where Fish Are Plentiful.

Sheffield	4.1	49.4	19.7
Great Barrington	6.2	55.6	13.5
Stockbridge	7.5	63.1	6.0
Lenox	6.0	69.1	0.0

Lenox-Manchester, 65.2 Miles.

	Miles to	Total Miles	Out Return
Lenox	0.0	0.0	65.2
Pittsfield	6.6	6.6	58.6
Lanesboro	5.3	11.9	53.3
S. Williamstown	11.4	23.3	41.9
Williamstown	5.4	28.7	36.5
Pownal Centre	4.6	33.3	31.9
Pownal	2.5	35.8	29.4
Bennington Cen- tre	6.3	42.1	23.1
S. Shaftsbury	5.1	47.2	18.0
Shaftsbury Cen- tre	3.6	50.8	14.4
Arlington	6.2	57.0	8.2
Manchester	8.2	65.2	0.0

Manchester-Sunapee Lake, 69.3

Miles.

	Miles to	Total Miles	Out Return
Manchester	0.0	0.0	69.3
Peru	11.5	11.5	57.8
Londonderry	5.0	16.5	52.8
Simonville	7.4	23.9	45.4
Chester	6.7	30.6	38.7
Springfield	8.3	38.9	30.4
N. Charlestown	9.1	48.0	21.3

Bretton Woods	5.4	18.8	3.0
Mount Washing- ton	0.6	19.4	2.4
Crawford Gap	2.4	21.8	0.0

Bretton Woods-Poland
Springs, 84.7 Miles.

	Miles to	Total Miles	Out Return
Bretton Woods	0.0	0.0	84.7
Bartlett	18.6	18.6	66.1
Glen Station	6.1	24.7	60.0
Intervale	4.1	28.8	55.9
Redstone	5.0	33.8	50.9
Center Conway	2.7	36.5	48.2
Fryeburg	4.6	41.1	43.6
East Fryeburg	6.4	47.5	37.2
Bridgeton	9.2	56.7	28.0
Naples	9.1	65.8	18.9
Cooks Mills	3.0	68.8	15.9
Webbs Mills	4.5	73.3	11.4
Poland	8.1	81.4	3.3
Poland Springs	3.3	84.7	0.0

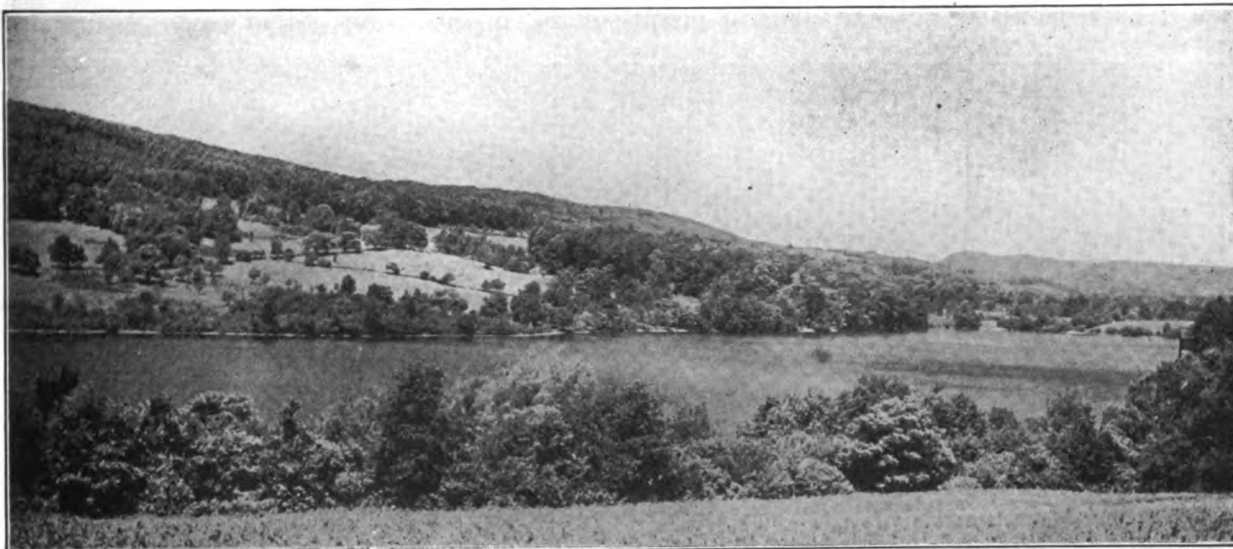
Poland Springs-Newcastle, 84.8
Miles.

	Miles to	Total Miles	Out Return
Poland Springs	0.0	0.0	84.8

Beverly Farms	2.7	59.1	30.0
Beverly	4.6	63.7	25.4
Salem	1.5	65.2	25.9
Swampscott	5.8	71.0	18.1
Lynn	1.9	72.9	16.2
Somerville	12.3	85.2	3.9
Boston	3.9	89.1	0.0

Boston-New London, 117.2
Miles.

	Miles to	Total Miles	Out Return
Boston	0.0	0.0	117.2
Dedham	10.8	10.8	106.4
Norwood	4.2	15.0	102.2
Walpole	4.1	19.1	98.1
Wrentham	6.9	26.0	91.2
Plainville	4.8	30.8	86.4
North Attleboro	1.6	32.4	84.8
Pawtucket	8.0	40.4	76.8
Providence	3.3	43.7	73.5
Apponaug	9.7	53.4	63.8
E. Greenwich	2.6	56.0	61.2
Hamilton	9.1	65.1	52.1
Narragansett Pier	9.9	75.0	42.2
Wakefield Sta- tion	2.7	77.7	39.5
Westerly	21.4	99.1	18.1
Mystic	9.2	108.3	8.9
Noank	2.6	110.9	6.3



View Across Prospect Lake in the Berkshire Hills.

Claremont	5.4	53.4	15.9
Newport	9.8	63.2	6.1
Guild	2.6	65.8	3.5
Sunapee	3.5	69.3	0.0

Lake Sunapee-Profile House,
81.2 Miles.

	Miles to	Total Miles	Out Return
Lake Sunapee	0.0	0.0	81.2
Georges Mills	2.9	2.9	78.3
New London	5.0	7.9	73.3
Elkins	3.0	10.9	70.3
Wilnot Flat	2.3	13.2	68.0
West Andover	3.1	16.3	64.9
Danbury	6.1	22.4	58.8
Bridgewater	14.1	36.5	44.7
East Hebron	4.9	41.4	39.8
Plymouth	8.8	50.2	31.0
West Campton	7.1	57.3	23.9
West Thornton	6.5	63.8	17.4
Woodstock	3.4	67.2	14.0
Profile House	14.0	81.2	0.0

Profile House-Bretton Woods-
Crawford's Gap, 21.8 Miles.

	Miles to	Total Miles	Out Return
Profile House	0.0	0.0	21.8
Twin Mountain House	13.4	13.4	8.4

Dry Mills	8.2	8.2	76.6
Gray	2.7	10.9	73.9
West Falmouth	9.9	20.8	64.0
Allen's Corners	3.2	24.0	60.8
Portland	3.7	27.7	57.1
Scarboro	5.7	33.4	51.4
Saco	8.6	42.0	42.8
Biddeford	0.9	42.9	41.9
Kennebunk	9.2	52.1	32.7
Wells	4.6	56.7	28.1
Ogunquit	5.5	62.2	22.6
Cape Neddick	3.3	65.5	19.3
York Beach	2.7	68.2	16.6
York Harbor	2.8	71.0	13.8
Kittery	8.2	79.2	5.6
Portsmouth	2.0	81.2	3.6
Newcastle	3.6	84.8	0.0

Newcastle-Boston, 89.1 Miles.

	Miles to	Total Miles	Out Return
Newcastle	0.0	0.0	89.1
Eaton's Corners	19.7	19.7	69.4
Salisbury	3.9	23.6	65.5
Newburyport	2.6	26.2	62.9
Newburyport Old Town	3.7	29.9	59.2
Rowley	4.2	34.1	55.0
Ipswich	3.7	37.8	51.3
Essex	5.4	43.2	45.9
W. Gloucester	3.6	46.8	42.3
Manchester-by- the-Sea	9.6	56.4	32.7

Groton	6.2	117.1	0.1
New London	0.1	117.2	0.0

New London-New York, 128.5
Miles.

	Miles to	Total Miles	Out Return
New London	0.0	0.0	128.5
Flanders	6.3	6.3	122.2
Lyme	9.6	15.9	112.6
Old Saybrook	10.5	26.4	102.1
Clinton	2.0	28.4	100.1
Madison	4.9	33.3	95.2
Guilford	5.2	38.5	90.0
Branford	9.0	47.5	81.0
East Haven	3.3	50.8	77.7
New Haven	4.1	54.9	73.6
West Haven	3.6	58.5	70.0
Savin Rock	1.1	59.6	68.9
Woodmont	4.0	63.6	64.9
Milford	4.7	68.3	60.2
Stratford	4.6	72.9	55.6
Bridgeport	3.8	76.7	51.8
Fairfield	4.5	81.2	47.3
Westport	1.6	82.8	45.7
Norwalk	3.3	86.1	42.4
Darien	4.2	90.3	38.2
Stamford	4.5	94.8	33.7
Greenwich	5.1	99.9	28.6
Portchester	3.1	103.0	25.5
Rye	1.7	104.7	23.8
Larchmont	5.3	110.0	18.5
New Rochelle	1.8	111.8	16.7
New York	16.7	128.5	0.0

OUTSKIRTS OF NEW ENGLAND.

A Month's Tour Through Famous Summer Resorts, Mountains, Historic Cities and Villages and Into Eastern Canada.

ANOTHER tour of New England which also gives the tourist a glimpse of eastern New York state and points of interest in New Brunswick, can be made in about a month, with liberal allowances for sightseeing, as the territory is as rich in historic as well as natural interest as any part of the country. This tour is identical at many points with the one first described and for that reason affords an opportunity for the motorist to make cut-offs or change his route frequently.

The first leg of the run is to Hudson, midway between Poughkeepsie and Albany, where a turn is made to the east through the famous Berkshire hills to

of the run, is on Lake Champlain.

The road runs out to the northeast to Newport, Vt., at the end of Lake Memphremagog, and just south of the Canadian border—a country with many opportunities for fishing. Thence the tourist goes south through St. Johnsbury to Bretton Woods, the heart of the White mountains, where he may visit Mount Washington.

Through the valley of the Connecticut river the road now runs north. At Groveton, the foothills of the White mountains are left behind. At Colebrook the road leaves the Connecticut river and shortly strikes the Mohawk, which it follows through the industrial town of Dixville to the Dixville

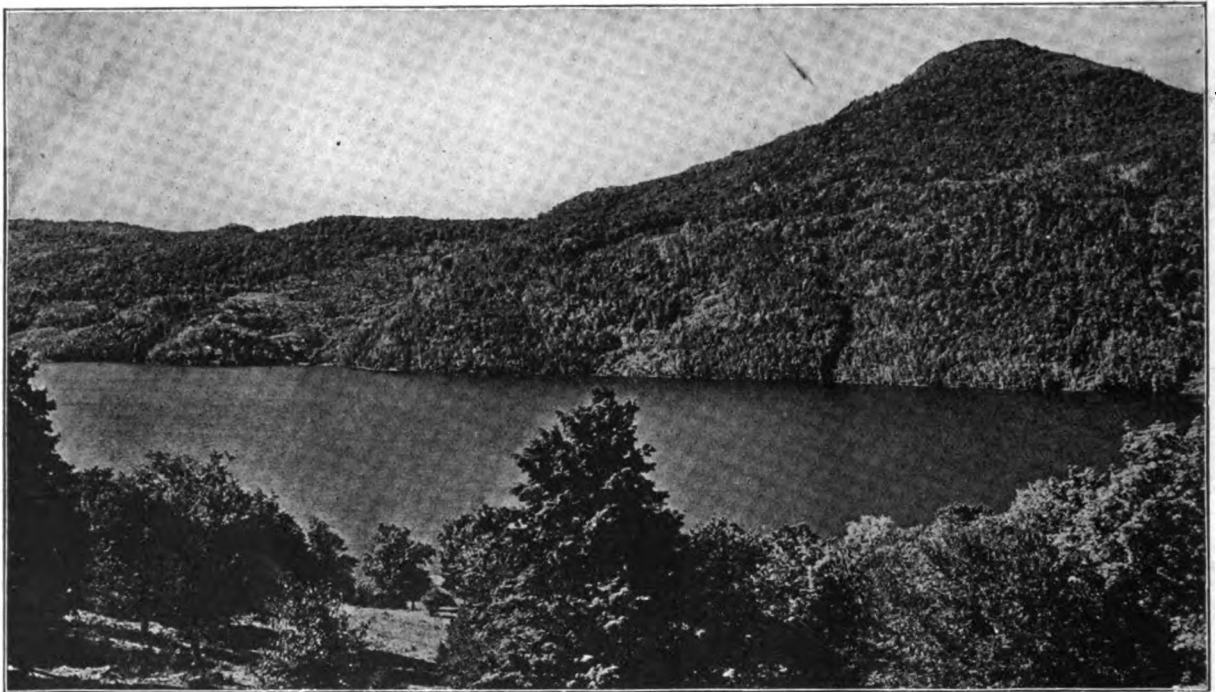
junction with the Kenduskeag.

Through Bangor the road goes to Ellsworth, where it crosses to Mt. Desert Island, on which the famous summer resort of Bar Harbor is located.

The road to St. Johns is a good dirt highway through a rolling, picturesque country along the shore line.

Beyond St. John the road leads to Moncton. The going is very good. The road follows the valley of the Petitcodiac river, which is famous the world over for its abnormal tides.

Beyond Moncton to Chatham, at the head of Miramichi bay, off the gulf of St. Lawrence, the roads are of poorer quality and



Looking Toward Owl's Head Across Lake Memphremagog in Vermont.

Pittsfield, in the heart of the Berkshires.

Thence the road lies north through Manchester, a town with many attractions as a summer resort, to Rutland, the centre of the quarrying industry of Vermont—a district that supplies the United States with most of its marble—to Burlington. At Pittsford is the largest quarry in the United States. In a nearby gorge there is ice that never melts even in midsummer. Near Salisbury the tourist passes along the shore of Lake Dumore, a sparkling Green mountain lake of great beauty. The Green mountain scenery is very fine. Burlington, at the end

Notch, and at Newry the road strikes the direct route from Bretton Woods to Rangeley lakes.

From Rangeley to Moosehead, an even greater fishing ground, the road runs through a sparsely settled country heavily wooded—the great Maine woods, so much beloved by hunters.

The station on Moosehead lake is Greenville Junction, where a large, new garage has been constructed to take care of the cars of tourists.

From Greenville Junction the road goes over excellent gravel to Bangor, at the head of navigation on Penobscot river, and at its

the country is wild. Yet the route is quite passable in dry weather, but after heavy rains it should not be attempted. From Chatham another day's run over very similar roads, although removed from the coast and through a wild country of woods and lakes, leads to Fredrickton.

The next day takes the tourist through Woodstock to Houlton, Me. Houlton is the metropolis of Aroostook county, Maine.

Out of Houlton the road runs through the heart of the woods, passing many busy saw mills and crossing rivers that tumble down their rough beds and over beautiful falls on their way to the At-



Along a Hillside in the Berkshires.

lantic ocean. The road passes Mt. Katahdin, of volcanic origin. From its rugged top can be seen most of the lakes and mountains of northern Maine, spread out below.

A series of lively lumbering towns punctuate the route. These include Mattawamkeag, Lincoln, Winn, Passadumkeag, Olamon and Costigan. But the most important place of this sort is Old Town, not very far from Bangor. Between Old Town and Bangor, the road passes through Orono, the seat of the University of Maine. Set in the fields some distance from the town the old buildings of this institution present a picture of great beauty.

For a time the route passes along Penobscot Bay and Mt. Desert can again be seen in the distance. Camden is a picturesque town, surrounded by a group of mountains, in which the two Meguntook peaks are included. There are many hills along the road through Rockport and Rockland.

Thomaston is located on a deep, narrow harbor, and here is the Maine state's prison, which was

founded in 1824. Damariscotta and Newcastle, on opposite sides of the Damariscotta river, were settled about 1640.

Bath is another town of glorious past. It is situated on the Kennebec river, 12 miles from the sea. It was a town of great importance and wealth during the period of American maritime dominance.

The night stop is Portland, the metropolis of Maine. The next day's run is from Portland, Me., to Concord, N. H., along the coast, through Kennebunk, settled in 1602, with a long history of Indian troubles, to Wells, not far from Portsmouth, N. H., where it turns inland to Dover and goes straight west to Concord, the capital of New Hampshire.

South from Concord the route goes through Acton and Nashua, through Wrentham and North Attleboro and on into Pawtucket, R. I.

Pawtucket is another manufacturing town. Its many large factories are devoted chiefly to textile trades, although many other lines are represented. It was the scene of the destruction of Captain Pierce and 70 men in 1676.

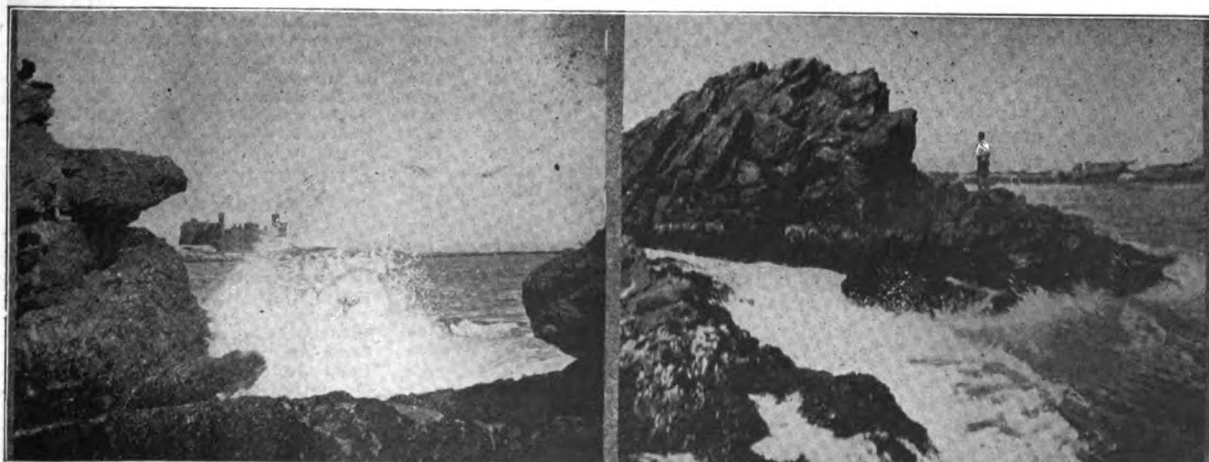
They were attacked near the shore of the Blackstone river. The first cotton mill in the United States was built in Pawtucket and is still standing near the falls, over which a bridge takes the tourist into the centre of the town.

Providence was settled by Roger Williams after he had been driven by religious prejudice from Salem. The city abounds with memorials to him and his body rests in North cemetery. Among the points of interest are the old and new state houses, the First Baptist church, founded by Roger Williams, Roger Williams park, the Athenaeum and Brown university.

Out of Providence the road passes through Fall River to New Bedford, on the southern shore of Cape Cod, and then crosses the cape to Sagamore. The towns along here, Onset, Sagamore, Barnstable and Yarmouth port, have supplied countless sailors to the old American merchant marine. The road goes along the shore of Buzzard's bay, passing the summer home of the late President Cleveland. Fairhaven was the summer home of H. H. Rogers, late president of the Standard Oil Company. For many years he was superintendent of streets there and the fine roads in and about the town were very largely a gift from him to the town.

Through the villages of Dennis, East Dennis, Brewster, Orleans, Eastham, Wellfleet, Truro to Provincetown, on the extreme end of the cape, the road passes a district peopled by quaint maritime folk, whose sturdy peculiarities have formed the theme of much excellent American literature.

Leaving Provincetown the next day the tourist goes down the eastern edge of the cape, through many more maritime towns and across the south side to New Bedford and from there to Newport. The city is most famous to the



The Surf at Ochre Point and Brenton Point on the Rocky Sea Coast at Newport, R. I.

readers of the Sunday newspapers as the site of the summer homes of many of New York's very wealthy families.

Newport is reached by way of Tiverton, crossing the island of Rhode Island. The cliff walk leading for many miles along the shore and traversing many of the great estates, is of much interest. But in addition to the social position of its inhabitants, Newport is interesting in a historical way. There is an old stone mill here, which was found when the earliest settlers cleared away the woods to make a home for themselves.

From Newport the next day's run leads via Taunton, Mass., to Plymouth, where the Pilgrims first landed. Off the town in 1620 the Mayflower cast anchor. A rock supposed to be the one upon which the first Pilgrim set foot has been preserved and is now to be seen on the shore with a canopy erected over it.

ban character as New York City is approached.

ITINERARY. NEW ENGLAND—CANADA.

Night Stops—New York, Pittsfield, Mass.; Burlington, Vt.; Bretton Woods, Dixville, N. H.; Rangeley, Moosehead Lake, Bar Harbor, Me.; St. Stephens, St. John, Moncton, Fredricton, N. B.; Houlton, Bangor, Portland, Me.; Concord, N. H.; Providence, R. I.; Provincetown, Mass.; Newport, R. I.; Plymouth, Springfield, Mass.; New York City. Twenty-two Days, 2553.5 Miles.

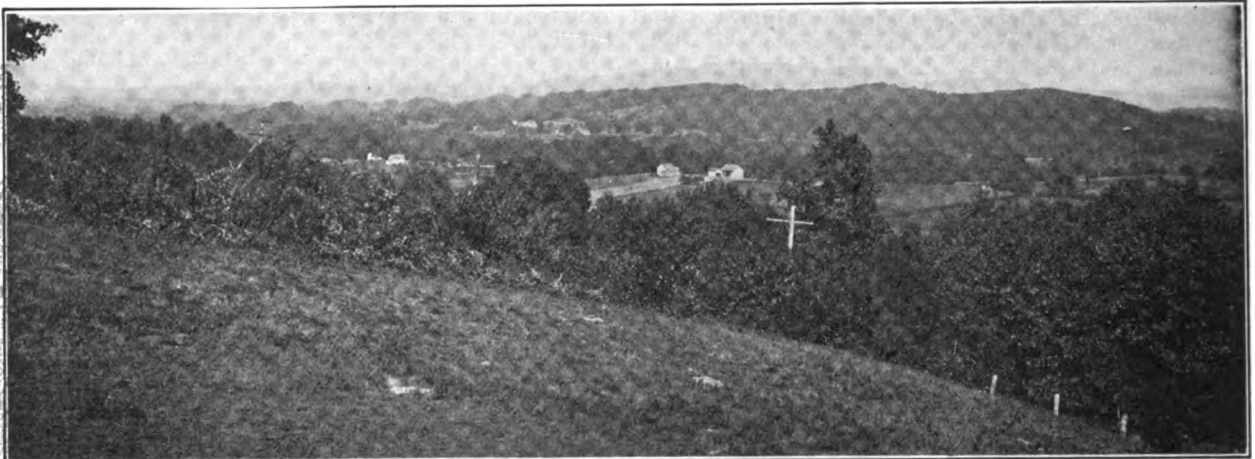
New York-Pittsfield (via Hudson), 155.3 Miles.

	Miles to	Total Miles	Out Return
New York	0.0	0.0	155.3
Yonkers	12.9	12.9	142.4
Hastings-On-Hudson	4.5	17.4	137.9

Manchester	8.0	58.5	111.9
East Dorset	6.5	65.0	105.4
Danby	7.4	72.4	98.0
Wallingford	9.4	81.8	88.6
Clarendon	3.4	85.2	85.2
Rutland	6.6	91.8	78.6
West Rutland	4.0	95.8	74.6
Castleton	7.4	103.2	67.2
Castleton Corners	1.7	104.9	65.5
Hubbardton	7.1	112.0	58.4
Hyde Manor	5.7	117.7	52.7
Sudbury	1.3	119.0	51.4
Whiting	4.6	123.6	46.8
Cornwall	6.9	130.5	39.9
Middlebury	4.3	134.8	35.6
Brookville	3.6	138.4	32.0
New Haven Junction	5.5	143.9	26.5
Vergennes	3.8	147.7	22.7
Shelburne	15.8	163.5	6.9
Burlington	6.9	170.4	0.0

Burlington-Bretton Woods (via Newport), 161 Miles.

	Miles to	Total Miles	Out Return
Burlington	0.0	0.0	161.0
Essex Center	9.6	9.6	151.4
Underhill	6.4	16.0	145.0
Cambridge	10.2	26.2	134.8
Jeffersonville	2.6	28.8	132.2
Johnson	8.9	37.7	123.3
North Hyde Park	5.5	43.2	117.8
Eden	4.0	47.2	113.8



Looking Across the Naugatuck Valley in Connecticut.

The next day's run goes west through Taunton, Worcester and to Springfield. It passes through Brockton, a centre of the shoe manufacturing trade, and most of the cities are of a strongly industrial character. Worcester is situated among the hills of Blackstone valley, and its many industries have been greatly aided by the fact that it has long been a leading New England railroad centre. It has also been remarkable for its many schools, colleges, seminaries and academies.

Springfield is the site of the old United States armory, where were produced the famous Springfield rifles.

Waterbury is built at the junction of the Mad and the Naugatuck rivers. It is chiefly notable as an industrial town, though it has many fine residences and pleasant streets. Danbury is a manufacturing city which has long been the centre of hat trade in the United States. The country beyond Danbury takes on a subur-

Dobbs Ferry	1.0	18.4	136.9
Tarrytown	5.0	23.4	131.9
Scarboro	4.2	27.6	127.7
Ossining	1.7	29.3	126.0
Harmon	2.7	32.0	123.3
Peekskill	8.8	40.8	114.5
Wappinger's Falls	24.1	64.9	90.4
Poughkeepsie	7.6	72.5	82.8
Hyde Park	6.1	78.6	76.7
Rhinebeck	10.0	88.6	66.7
Red Hook	5.4	94.0	61.3
Livingston	12.1	106.1	49.2
Hudson	8.3	114.4	40.9
Claverack	4.5	118.9	36.4
Mellenville	4.1	123.0	32.3
Ghent	6.2	129.2	26.1
Chatham	2.2	131.4	23.9
New Concord	5.0	136.4	18.9
East Chatham	1.1	137.5	17.8
Queecy, N. Y.	5.6	143.1	12.2
Shaker Village, Mass.	7.5	150.6	4.7
Pittsfield, Mass.	4.7	155.3	0.0

Pittsfield-Burlington, 170.4 Miles.

	Miles to	Total Miles	Out Return
Pittsfield	0.0	0.0	170.4
Lanesboro	5.2	5.2	165.2
S. Williamstown	11.3	16.5	153.9
Williamstown	5.0	21.5	148.9
Pownal, Vt.	4.4	25.9	144.5
Bennington	9.4	35.3	135.1
S. Shaftsbury	5.3	40.6	129.8
Arlington	9.9	50.5	119.9

Westfield	16.5	63.7	97.3
Troy	2.0	65.7	95.3
Newport	10.5	76.2	84.8
West Derby	1.2	77.4	83.6
Derby	3.4	80.8	80.2
West Charleston	5.5	86.3	74.7
Westmore	10.7	97.0	64.0
West Burke	10.1	107.1	53.9
Lyndon Center	8.3	115.4	45.6
St. Johnsbury Centre	6.2	121.6	39.4
St. Johnsbury	2.8	124.4	36.6
Lower Waterford	9.6	134.0	27.0
Waterford	3.1	137.1	23.9
Littleton	5.4	142.5	18.5
Bethlehem	4.0	147.4	13.6
Bethlehem Jct.	3.1	150.5	10.5
Bretton Woods	10.5	161.0	0.0

Bretton Woods-Dixville Notch, 69.7 Miles.

	Miles to	Total Miles	Out Return
Bretton Woods	0.0	0.0	69.7
Twin Mountain House	5.4	5.4	64.3
Whitefield	8.6	14.0	55.7
Lancaster	8.5	22.5	47.2
Coos Junction	1.4	23.9	45.8
Groveton, N. H.	8.7	32.6	37.1
Stratford Hollow	5.0	37.6	32.1
North Stratford	8.5	46.1	23.6
Colebrook	13.2	59.3	10.4
Kidderville	6.7	66.0	3.7
Dixville Notch	3.7	69.7	0.0



The Flume, Dixville Notch, New Hampshire Mountains.

Dixville Notch-Rangeley, 109.8 Miles.

	Miles to	Total Miles	Out Return
Dixville Notch...	0.0	0.0	109.8
Errol	11.8	11.8	98.0
Upton, Me.	9.6	21.4	88.4
Newry	21.1	42.5	67.3
Hanover	5.2	47.7	62.1
Rumford Point..	1.7	49.4	60.4
Rumford Center..	4.3	53.7	56.1
Rumford	5.4	59.1	50.7
Ridgelyville	1.9	61.0	48.8
Dixfield	4.4	65.4	44.4
Weld	12.1	77.5	32.3
Webb	2.3	79.8	30.0
Madrid	14.8	94.6	15.2
Rangeley, Me.	15.2	109.8	0.0

Rangeley-Moosehead Lake, 133.7 Miles.

	Miles to	Total Miles	Out Return
Rangeley	0.0	0.0	133.7
Dead River Station	4.5	4.5	129.2
Stratton	15.3	19.8	113.9
North New Portland	37.1	56.9	76.8
North Anson	8.3	65.2	68.5
Lakewood	6.8	72.0	61.7
Skowhegan	5.7	77.7	56.0
N. Cornville	10.7	88.4	45.3
Athens	2.0	90.4	43.3
Brighton	8.6	99.0	34.7
Kingsbury	5.9	104.9	28.8
Blanchard	12.8	117.7	16.0
Greenville	14.6	132.3	1.4
Greenville Jet... 1.4	133.7	0.0	

Moosehead Lake-Bar Harbor, 109 Miles.

	Miles to	Total Miles	Out Return
Greenville Jet... 0.0	0.0	109.0	
Greenville	1.6	1.6	107.4
Monson	13.5	15.1	93.9
Abbott	6.1	21.2	87.8
Gulford	5.2	26.4	82.6
Dover	8.0	34.4	74.6
West Charleston..	11.7	46.1	62.9
East Corinth	5.0	51.1	57.9
Kenduskeag	8.0	59.1	49.9
Bangor	14.0	73.1	35.9
Brewer	0.7	73.8	35.2
E. Orrington	5.8	79.6	29.4
North Ellsworth 12.8	92.4	16.6	
Ellsworth Falls.. 6.0	98.4	10.6	
Ellsworth	1.7	100.1	8.9
Mt. Desert Island (Bar Harbor) .. 8.9	109.0	0.0	

Bar Harbor-St. Stephen, 114.9 Miles.

	Miles to	Total Miles	Out Return
Bar Harbor	0.0	0.0	114.9
Ellsworth	8.9	8.9	106.0
Hancock	10.0	18.9	96.0
West Sullivan Ferry	1.1	20.0	94.9

Rothsday	7.4	8.9	87.0
Hampton Station	13.5	22.4	73.5
Sussex	22.8	45.2	50.7
Pettitcodiac	26.0	71.2	24.7
River Glade	5.2	76.4	19.5
Salisbury	5.4	81.8	14.1
Moncton	14.1	95.9	0.0

Moncton-Chatham, 88 Miles.

	Miles to	Total Miles	Out Return
Moncton	0.0	0.0	88.0
Cocagne	22.3	22.3	65.7
Bucktouce	11.0	33.3	54.7
Rexton	14.7	48.0	40.0
Richibucto	2.6	50.6	37.4
Chatham	37.4	88.0	0.0

Chatham-Fredricton, 105.8 Miles.

	Miles to	Total Miles	Out Return
Chatham	0.0	0.0	105.8
Newcastle Ferry 4.6	4.6	101.2	
Derby Jct. 3.6	8.2	97.6	
Millerton	4.4	12.6	93.2
Blackville	15.6	28.2	77.6
Donktown	21.4	49.6	56.2
Bolstown	15.4	65.0	40.8
Covered Bridge.. 18.0	83.0	22.8	
Nashua	9.5	92.5	13.3
Marysville	9.3	101.8	4.0
Fredricton, N. B. 4.0	105.8	0.0	

Fredricton-Houlton, 79.7 Miles.

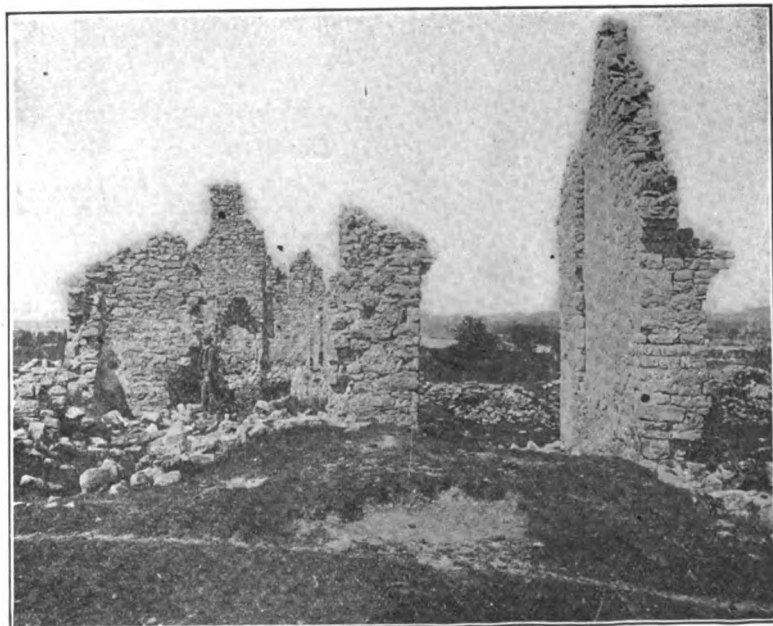
	Miles to	Total Miles	Out Return
Fredricton	0.0	0.0	79.7
Long	16.9	16.9	62.8
Prince William.. 5.4	22.3	57.4	
Hawshaw	15.4	37.7	42.0
Temple	19.2	56.9	22.8
Woodstock, N. B. 7.0	63.9	15.8	
Richmond Corners	6.7	70.6	9.1
Houlton, Me. 9.1	79.7	0.0	

Houlton-Bangor, 116.2 Miles.

	Miles to	Total Miles	Out Return
Houlton	0.0	0.0	116.2
Linneus	8.6	8.6	107.6
Haynesville	16.0	24.6	91.6
Macwahoc	19.5	44.1	72.1
Matawankeag	9.7	53.8	62.4
Lincoln	13.8	67.6	48.6
S. Lincoln	5.3	72.9	43.3
W. Enfield	6.6	79.5	36.7
Passadumkeag	4.9	84.4	31.8
Olamon	4.5	88.9	27.3
Costigan	8.9	97.8	18.4
Old Town	5.7	103.5	12.7
Orono	4.9	108.4	7.8
Bangor	7.8	116.2	0.0

Bangor-Portland, 140.8 Miles.

	Miles to	Total Miles	Out Return
Bangor	0.0	0.0	140.8



Ruins on Site of Fort Ticonderoga.

Hampden	6.0	6.0	124.8
Winterport	7.0	13.0	127.8
Frankfort	2.8	15.8	125.0
Prospect	4.1	19.9	120.9
Searsport	9.0	28.9	111.9
Belfast	5.4	34.3	106.5
Northport	7.8	42.1	98.7
Lincolntonville	5.1	47.2	93.6
Camden	5.6	52.8	88.0
Rockport	1.9	54.7	86.1
Rockland	6.2	60.9	79.9
Thomaston	4.1	65.0	75.8
West Warren	5.1	70.1	70.7
Waldoboro	6.6	76.7	64.1
Damariscotta	10.5	87.2	53.6
New Castle	0.3	87.5	53.3
Wiscasset	8.7	96.2	44.6
Mont Sweng	4.3	100.5	40.3
Woolwich	5.2	105.7	35.1
Bath	0.0	105.7	35.1
Brunswick	9.1	114.8	26.0
Freeport	8.5	123.3	17.5
Yarmouth	5.7	129.0	11.8
Falmouth Fore- side	5.4	134.4	6.4
Portland	6.4	140.8	0.0

Portland-Concord, 86.4 Miles.

	Miles to	Total Miles	Out Return
Portland	0.0	0.0	86.4
Scarboro	5.7	5.7	80.7
Saco	8.6	14.3	72.1
Biddeford	0.9	15.2	71.2
Kennebunk	9.2	24.4	62.0

North Attleboro, Mass.	6.4	107.7	12.3
Pawtucket, R. I.	8.0	115.7	4.3
Providence	4.3	120.0	0.0

Providence-Provincetown,
122.9 Miles.

	Miles to	Total Miles	Out Return
Providence	0.0	0.0	122.9
Seekonk, Mass.	4.5	4.5	118.4
Luther's Corners	8.3	12.8	110.1
Swansea	2.1	14.9	108.0
Fall River	4.6	19.5	103.4
Westport Fac- tory	6.9	26.4	96.5
New Bedford	6.3	32.7	90.2
Fairhaven	1.9	34.6	88.3
Mattapoisett	5.1	39.7	83.2
Marion	5.0	44.7	78.2
Wareham	5.8	50.5	72.4
Onset	3.8	54.3	68.6
Sagamore	8.9	63.2	59.7
Sandwich	2.0	65.2	57.7
W. Barnstable	7.7	72.9	50.0
Barnstable	3.1	76.0	46.9
Yarmouth Port	3.0	79.0	43.9
Dennis	4.5	83.5	39.4
E. Dennis	2.0	85.5	37.4
Brewster	4.6	90.1	32.8
Orleans	5.4	95.5	27.4
Eastham	3.9	99.4	23.5
S. Wellfleet	6.6	106.0	16.9

Marion	5.8	107.2	41.2
Mattapoisett	5.0	112.2	36.3
Fair Haven	5.1	117.3	31.1
New Bedford	1.9	119.2	29.2
Westport Fac- tory	6.3	125.5	22.9
Bliss Corners, R. I.	6.6	132.1	16.3
Tiverton	4.1	136.2	10.9
Newport	12.2	148.4	0.0

Newport-Plymouth (via Taun-
ton), 60.1 Miles.

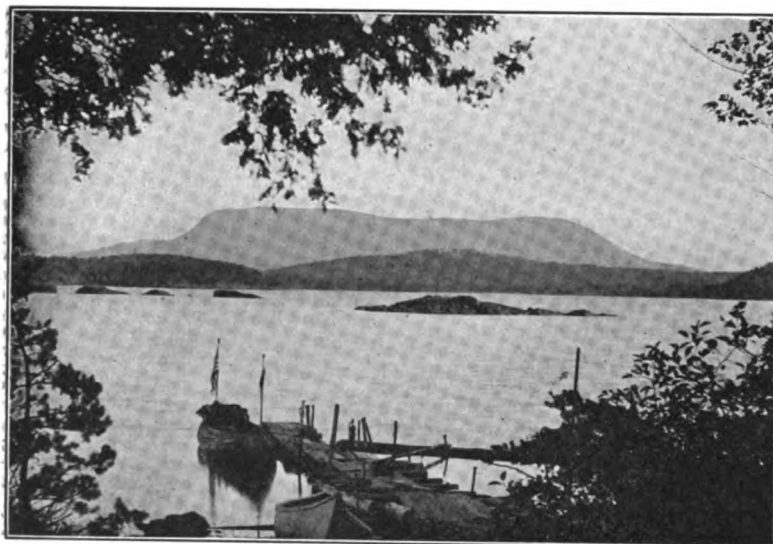
	Miles to	Total Miles	Out Return
Newport	0.0	0.0	60.1
Fall River	18.5	18.5	41.6
Somerset	5.9	24.4	35.7
Taunton	9.9	34.3	25.8
Hart's Corners	1.9	36.2	23.9
Middleboro	9.2	45.4	14.7
Middleboro Green	1.8	47.2	12.9
Waterville	3.1	50.3	9.8
N. Carver	1.8	52.1	8.0
Plymouth	8.0	60.1	0.0

Plymouth-Springfield, 131.9
Miles.

	Miles to	Total Miles	Out Return
Plymouth	0.0	0.0	131.9
Kingston	4.5	4.5	127.4
West Duxbury	4.3	8.8	123.1
Hanover	4.9	13.7	118.2
Whitman	7.7	21.4	110.5
Brockton	4.3	25.7	106.2
Stoughton	6.2	31.9	100.0
Sharon	4.9	36.8	95.1
Walpole	5.2	42.0	89.9
Medfield	4.4	46.4	85.5
Sherborn	6.1	52.5	79.4
S. Framingham	4.0	56.5	75.4
Ashland	3.2	59.7	72.2
Westboro	8.9	68.6	63.3
North Grafton	6.2	74.8	57.1
Worcester	6.1	80.9	51.0
Cherry Valley	4.2	85.1	46.8
Spencer	6.8	91.9	40.0
E. Brookfield	3.9	95.8	36.1
Brookfield	2.9	98.7	33.2
Warren	6.2	104.9	27.0
Palmer	11.6	116.5	15.4
N. Wilbraham	5.1	121.6	10.3
Springfield	10.3	131.9	0.0

Springfield-New York City,
149.9 Miles.

	Miles to	Total Miles	Out Return
Springfield	0.0	0.0	149.9
Windsor Locks, Conn.	13.5	13.5	136.4
Windsor	5.6	19.1	130.8
Hartford	6.5	25.6	124.3
Farmington	9.0	34.6	115.3
Plainville	4.0	39.2	110.7
Southington	4.7	43.9	106.0
Plantville	1.6	45.5	104.4
Waterbury	10.6	56.1	93.8
Middlebury	5.6	61.7	88.2
Southbury	9.1	70.8	79.1
Sandy Hook	6.4	77.2	72.7
Newtown	1.5	78.7	71.2
Danbury	9.4	88.1	61.8
Ridgefield, Conn.	9.3	97.4	52.5
S. Salem, N. Y.	3.8	101.2	48.7
Bedford	9.0	110.2	39.7
White Plains	15.9	126.1	23.8
Hart's Corners	2.4	128.5	21.4
Bronxville	5.9	134.4	15.5
New York	15.5	149.9	0.0



Lobster Lake, Maine—Spencer Mountain in the Background.

Wells	4.6	29.0	57.4
North Berwick	9.0	38.0	48.4
S. Berwick, Me.	6.4	44.4	42.0
Dover, N. H.	4.3	48.7	37.7
Barrington	9.8	58.5	27.9
El. Northwood	6.1	64.6	21.8
Northwood Cen- ter	3.6	68.2	18.2
Epsom	7.4	75.6	10.8
Gossville	0.6	76.2	10.2
Concord	10.2	86.4	0.0

Concord-Providence, 120 Miles.

	Miles to	Total Miles	Out Return
Concord	0.0	0.0	120.0
Pembroke	5.8	5.8	114.2
Suncook	1.5	7.3	112.7
Manchester	10.7	18.0	102.0
Merrimack	8.7	26.7	98.3
Thornton's Ferry	3.5	30.2	89.8
Nashua, N. H.	5.9	36.1	83.9
Tyngsboro, Mass.	6.4	42.5	77.5
Chelmsford	6.5	49.0	71.0
North Acton	8.7	57.7	62.3
Sudbury	13.3	71.0	49.0
East Sudbury	2.0	73.0	47.0
Saxonville	3.2	76.2	43.8
South Framing- ham	3.7	79.9	40.1
Sherborn	4.0	83.9	36.1
Medfield	6.1	90.0	30.0
Walpole	4.4	94.4	25.6
Wrentham	6.9	101.3	18.7

Provincetown-Newport (via
Chatham), 148.4 Miles.

	Miles to	Total Miles	Out Return
Provincetown	0.0	0.0	148.4
N. Truro	6.3	6.3	142.1
Wellfleet	8.2	14.5	133.9
Eastham	9.0	23.5	124.9
Orleans	3.5	27.0	121.4
Chatham	9.6	36.6	111.8
South Harwich	5.2	41.8	106.6
West Dennis	7.1	48.9	99.5
S. Yarmouth	0.8	49.7	98.7
Hyannis	5.1	54.8	93.6
Centerville	4.1	58.9	89.5
Osterville	3.1	62.0	86.4
Marston's Mills	2.3	64.3	84.1
East Falmouth	10.0	74.3	74.1
Falmouth	4.2	78.5	69.9
N. Falmouth	7.3	85.8	62.6
Monument Beach	5.6	91.4	57.0
Onset	6.2	97.6	50.8
Wareham	3.8	101.4	47.0

OVER THE OLD MOHAWK TRAIL.

Through the Heart of Massachusetts, Connecticut and Rhode Island—Four Days
Among the Berkshire Hills.

A FOUR days' trip into the Berkshires and over the old Mohawk trail takes the tourist over a route not touched by the other tours and amid scenery that is marvelous. It lays through the heart of the three richest of the New England states, Massachusetts, Connecticut and Rhode Island, and over roads which for the larger part are the most recent examples of the road engineer's skill.

The tourist leaves Boston via Massachusetts and Commonwealth avenues. He passes the Harvard yard and Washington elm, under which Washington took command of the Continental army.

Passing through Arlington the road comes to Lexington, where the first skirmish of the Revolution was fought.

Seven miles further on is Concord, famous for its literary associations. Here Emerson, Hawthorne, the Alcotts and Thoreau had their homes. The road passes Grapevine cottage, where is the arbor on which Concord grapes were first grown. The houses of the famous writers are still standing and may be seen by the traveller.

A pleasant drive brings the tourist to Groton, which is now famous as the seat of a private school for boys. Then the road enters New Hampshire, and near Marlo comes to the foot of Mt. Monadnock, 1736 feet high.

The next day's run starts out of Keene, along the Ashuelot river to Hinsdale, and there turns up the Connecticut to Greenfield. At Greenfield the tourist comes upon the Mohawk trail. It is said to have been marked by the Indians in the time of King Phillip and to have been used by them as a thoroughfare from the Connecticut to the Hudson rivers.

From Greenfield the route follows the Deerfield river through Shelburne falls to a point two miles beyond Charlemont, where it turns up a winding climb of the eastern slope of Florida mountain. This is sometimes called Hoosac mountain. Whitcomb summit is climbed about 29 miles out from Greenfield. A flag pole marks the top of the mountain.

Few points in America have a scenic outlook superior to that from the top of the ridge. On a clear day the entire expanse of the Berkshires can be seen, with Mt. Greylock in the foreground and the Catskills, in New York, nearly

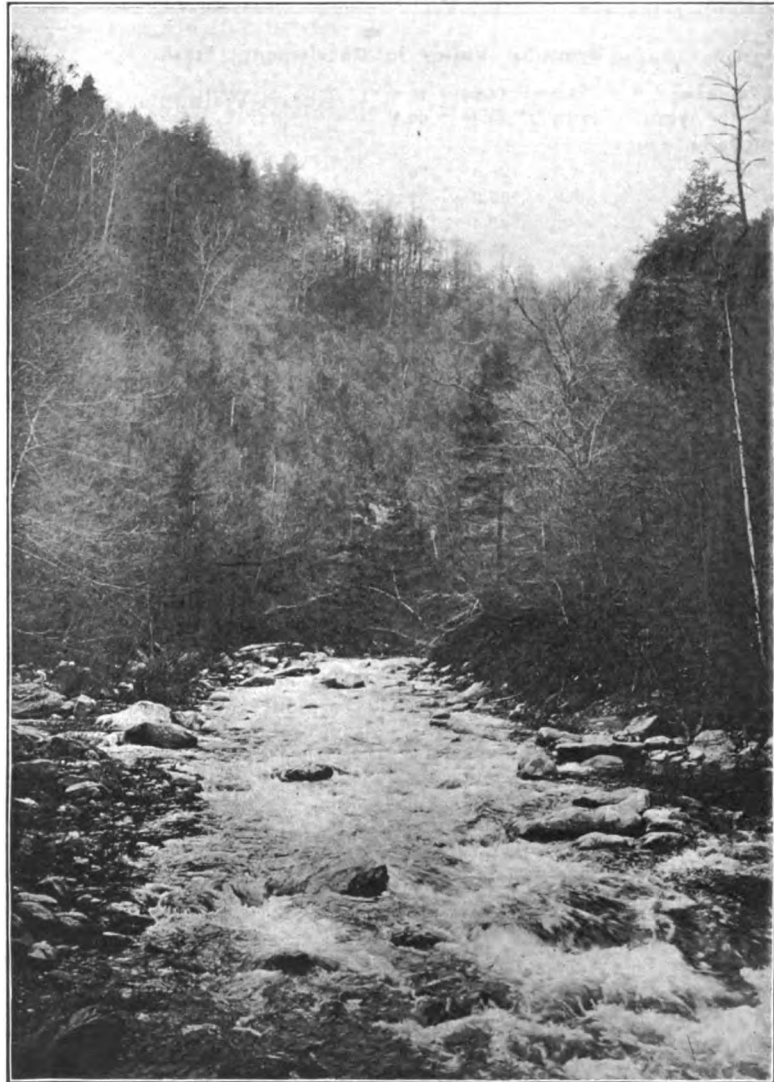
100 miles way, in the background. Immediately below are the tiled roofs of North Adams. From North Adams it is a short and pleasant run to Williamstown.

Out of Hartford the route follows the Hockanum river to Manchester. The picturesque Bolton notch is passed and then the road descends the valley of the Hop river. A great deal of fine new highway improved by the state is

bull, who was one of the financiers of the revolution. At Pomfret are the historical "wolf den" and a well known school for boys. Entering Providence, the road passes the magnificent state capital.

ITINERARY. MOHAWK TRAIL.

Night Stops—Boston, Mass.;



Rapids on the Deerfield River.

covered in this part of the trip.

Williamantic, in addition to being a very busy modern manufacturing town (sometimes called the "Thread City"), is well known for its historical associations. It was the home of Commodore Swift, U. S. N., General Lyon, who served in the revolution and was killed in the battle of Eastford; Nathan Hale and Jonathan Trum-

Keene, N. H.; Williamstown, Mass.; Hartford, Conn., and Providence, R. I. Four Days, 349.7 Miles.

Boston-Keene, 87.5 Miles.

	Total Miles	
	Miles to	Out Return
Boston	0.0	0.0 87.5
Cambridge	3.6	3.6 83.9
Arlington	3.3	6.9 80.6



Beautiful Valley in Charlemont, Mass.

Lexington	5.0	11.9	75.6
North Acton.....	13.5	25.4	62.1
Littleton Com-			
mon	2.9	28.3	59.2
Groton	6.9	35.2	52.3
Townsend	8.2	43.4	44.1
West Townsend. 2.0	45.4	42.1	
Ashby	4.6	50.0	37.5
West Rindge ...	12.9	62.9	24.6
Jaffrey	5.1	68.0	19.5
Marlboro	14.9	82.9	4.6
Keene	4.6	87.5	0.0

Keene-Williamstown, 80.8 Miles.

	Total Miles		
	Miles to	Out	Return
Keene	0.0	0.0	80.8
W. Swanzey	5.4	5.4	75.4
Westport	2.4	7.8	73.0
Winchester	5.3	13.1	67.7
Hinsdale	5.7	18.8	62.0
E. Northfield....	6.5	25.3	55.5
Northfield Village 1.0	26.3	54.5	

Bernardstown ...	6.1	32.4	48.4
Greenfield	6.8	39.0	41.4
Shelburne	5.2	44.2	36.6
Shelburne Falls..	3.9	48.1	32.7
Charlemont	8.7	56.8	24.0
Whitcomb Sum-			
mit	11.3	68.1	12.7
North Adams....	7.3	75.4	5.4
Williamstown ..	5.4	80.8	0.0

Williamstown-Hartford, 97.4 Miles.

	Total Miles		
	Miles to	Out	Return
Williamstown....	0.0	0.0	97.4
S. Williamstown. 5.4	5.4		92.0
Lanesboro	11.6	17.0	80.4
Pittsfield	5.3	22.3	75.1
Lenox	6.6	28.9	68.5
Stockbridge	5.9	34.8	62.6
Great Barring-			
ton	7.4	42.2	55.2
Sheffield	6.1	48.3	49.1
Ashley Falls,			
Mass.....	4.0	52.3	45.1
Canaan, Conn. ...	2.2	54.5	42.9
Norfolk	7.4	61.9	35.5
Winstead	9.3	71.2	26.2
New Hartford... 6.8	78.0	19.4	
Canton	6.3	84.3	13.1
Avon	3.7	88.0	9.4
Hartford	9.4	97.4	0.0

Hartford-Providence, 84 Miles.

	Total Miles		
	Miles to	Out	Return
Hartford	0.0	0.0	84.0
Manchester Cen-			
ter	8.7	8.7	75.3
Bolton Notch....	4.3	13.0	71.0
Andover	5.7	18.7	65.3
Williamantic	9.3	28.0	56.0
Phoenixville	14.5	42.5	41.5
Ablington	4.5	47.0	37.0
Pomfret Center..	2.8	49.8	34.2
Pomfret	2.1	51.9	32.1
Putnam, Conn. ...	3.4	55.3	28.7
Chepachet	13.3	68.6	15.4
Harmony	4.6	73.2	10.8
Providence	10.8	84.0	0.0

THE GREEN AND WHITE MOUNTAINS.

HAVING skirted the borders of New England over two different routes and passed over the Mohawk Trail from east to west, the only remaining territory available for an extended tour in this small section of the country lays from north to south in the interior. This route leads through the enchanting Green and White mountains, the summer playgrounds of thousands of tourists.

The trip starts from Springfield, Mass., and goes straight north. First it crosses the Connecticut river into West Springfield, where is the old Shay house, built in 1754 by Captain Shay, who was one of the leading spirits in Shay's rebellion. The road then leads along the west bank of the river to Holyoke, where there are many large paper mills.

Just beyond Holyoke is Mt. Tom, one of the highest peaks in the section, and a little further on Mt. Holyoke becomes visible.

In South Deerfield is a monument on the Bloody Brook battlefield. This battle took place Sept. 18, 1675.

After passing Greenfield, the eastern terminus of the Mohawk trail route, the river is again crossed and the tourist comes upon East Northfield.

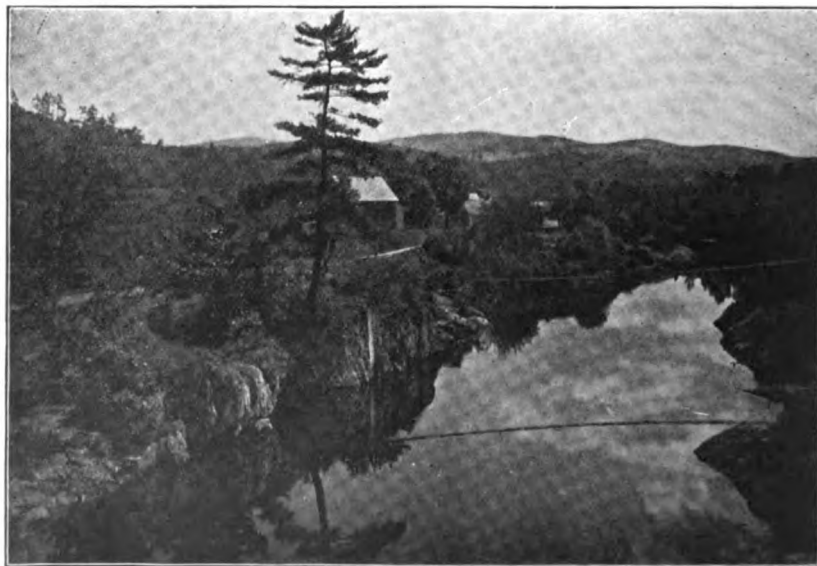
There is a great dam across the river at Vernon, Vt., which fur-

nishes Brattleboro with a fine lake front. Electricity furnished by the water that accumulates behind this dam supplies current to many towns in the northern Massachusetts as far distant as Worcester. Brattleboro is a business centre for a large part of Vermont and New Hampshire. Further on, at Putney, Vt., the earth contains great veins of roofing slate, which has been taken

out of the ground there for many years.

Bellows Falls was a favorite fishing ground for the Indians, who came there to catch salmon and shad near the rapids.

Not far above Claremont, Ascutney mountain comes into view, and at Ascutneyville the tourist again crosses the river in Vermont. At Windsor during a heavy thunderstorm and just after the



Winooski River Scene, Vermont.

news of the fall of Fort Ticonderoga had been received, the representatives of the Vermont towns adopted the state constitution July 2, 1777.

The night stop is made at White river junction, where the White and Connecticut rivers join.

The next day the route follows for a time the picturesque White river, branching off later to go through the Green mountains toward Montpelier.

Bethel is a busy manufacturing town among high hills. A little further on is the Williamstown gulf, through which a cool breeze is nearly always blowing. The view from this point to Barre and Montpelier is very fine.

Montpelier is the capital of Vermont. It is built on a plain near the Winooski river and is surrounded by highly developed farms on the hill sides.

St. Johnsbury was settled in

more falls. Newfound lake is reached two miles out of Bristol, N. H. Sugar Loaf mountain is on the west shore and Crosby mountain on the east. Bristol is a fine town at the confluence of the Pemigewasset and Newfound rivers.

The night stop is Concord. Through Concord and Manchester the road goes to Nashua.

Lowell is located at Pawtucket falls, which had once been a favorite fishing place of the Indians.

From Lowell it is a short and easy run through Burlington, Arlington and Cambridge to Boston.

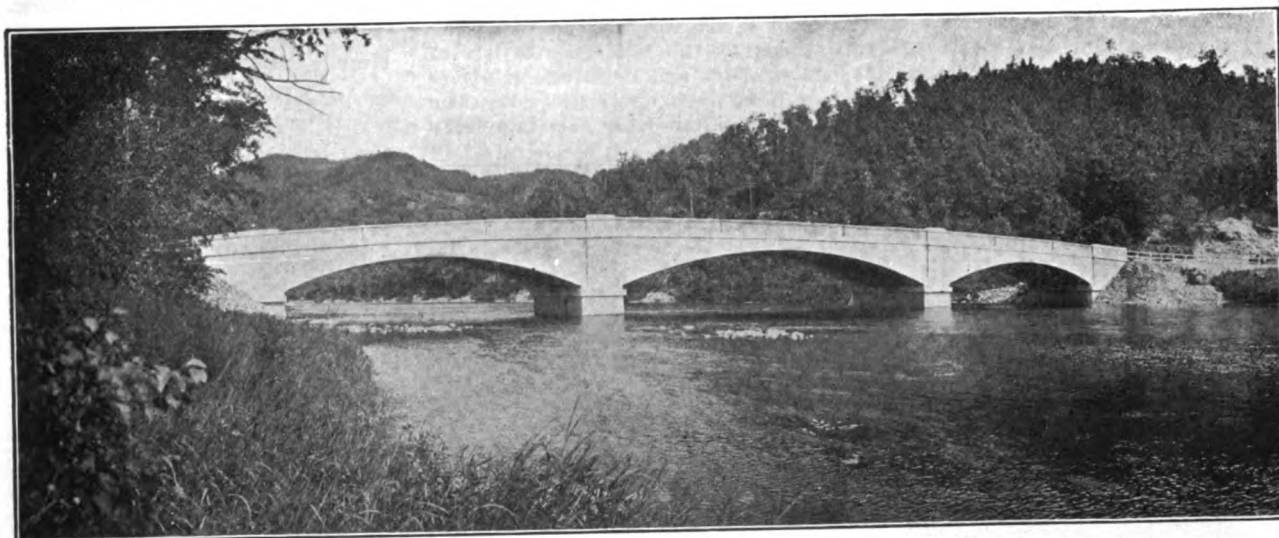
ITINERARY. SPRINGFIELD-BOSTON.

Night Stops—White River Junction, Vt.; White Mountains, Con-

Hartford	1.6	1.6	126.3
W. Hartford	5.9	7.5	120.4
Sharon	6.0	13.5	114.4
Royalton	7.0	20.5	107.4
E. Bethel	5.3	25.8	102.1
S. Randolph	1.5	27.3	100.6
E. Randolph	3.5	30.8	97.1
E. Brookfield	6.4	37.2	90.7
Williamstown ...	7.6	44.8	83.1
Barre	5.7	50.5	77.4
Montpelier	6.5	57.0	70.9
E. Montpelier ...	7.1	64.1	63.8
Plainfield	4.1	68.2	59.7
Marshfield	6.4	74.6	53.3
Molly's Falls ...	1.8	76.4	51.5
South Cabot	2.8	79.2	48.7
Danville	8.7	87.9	40.0
St. Johnsbury ...	7.3	95.2	32.7
Lower Waterford	10.7	105.9	22.0
Waterford	3.3	109.2	18.7
Littleton	5.5	114.7	13.2
Bethlehem	5.0	119.7	8.2
White Mountains	8.2	127.9	0.0

White Mountains-Concord,
110.5 Miles.

	Total Miles		
	Miles to	Out	Return
White Mountains	0.0	0.0	110.5
Woodstock	33.2	33.2	77.3



Concrete Arch Bridge Over Deerfield River.

1786 and named in honor of St. John de Crevecoeur, French consul at New York and a benefactor of the State of Vermont.

From the vicinity of Littleton fine views of the Franconia and White mountains may be obtained. It is on the Ammonoosoc river. The stop for the night is at Bretton Woods, in the White mountains.

Plymouth, on the Pemigewasset river, is one of the interesting points through which the tourist passes on the next day. Walker's hill overlooks the village and the valley and many of the great peaks of the region are visible in the distance. Mt. Prospect is four miles to the northeast and there is a good road to the summit.

The drive around Plymouth mountain is of much interest and from its summit the view is much the same as from Mt. Prospect, although heavy forests cover the sides of the peak. Two miles north of Plymouth are the Liver-

cord, N. H.; Boston, Mass. Four Days, 440.5 Miles.

Springfield-White River Junction, 122.6 Miles.

	Total Miles		
	Miles to	Out	Return
Springfield	0.0	0.0	122.6
Holyoke	8.7	8.7	113.9
Northampton ...	9.0	17.7	104.9
South Deerfield..	10.8	28.5	94.1
Deerfield	5.2	33.7	88.9
Greenfield	3.2	36.9	85.7
Barnardstown ...	6.4	43.3	79.3
Gullford	11.1	54.4	68.2
Brattleboro	2.8	57.2	65.4
Putney	9.2	66.4	56.2
Westminster ...	8.0	74.4	48.2
Bellows Falls ...	5.0	79.4	43.2
S. Charleston ...	3.5	82.9	39.7
Charleston	3.8	86.7	35.9
Claremont	10.8	97.5	25.1
W. Claremont ...	2.7	100.2	22.4
Ascutneyville ...	2.2	102.4	20.2
Windsor	5.3	107.7	14.9
Hartland	4.7	112.4	10.2
N. Hartland	4.6	117.0	5.6
White River Junction	5.6	122.6	0.0

White River Junction-White Mountains (Via Montpelier), 127.9 Miles.

	Total Miles		
	Miles to	Out	Return
White River Junction	0.0	0.0	127.9

West Thornton...	4.2	37.4	73.1
West Campton...	5.5	42.9	67.6
Plymouth	7.5	50.4	60.1
Ashland	5.9	56.3	54.2
Holderness	4.0	60.3	50.2
Meredith	7.8	68.1	42.4
The Weirs	4.7	72.8	37.7
Lake Port	4.6	77.4	33.1
Laconia	1.7	79.1	31.4
Tilton	9.3	88.4	22.1
Franklin Falls..	3.0	91.4	19.1
Franklin	0.8	92.2	18.3
Penacook	12.2	104.4	6.1
Concord	6.1	110.5	0.0

Concord-Boston, 76.7 Miles.

	Total Miles		
	Miles to	Out	Return
Concord	0.0	0.0	76.7
Pembroke	5.9	5.9	70.8
Suncook	1.4	7.3	69.4
Manchester	11.4	18.7	58.0
Merrimac	8.4	27.1	49.6
Thornton's Ferry	3.6	30.7	46.0
Nashua	5.9	36.6	40.1
Tyngsboro	6.5	43.1	33.6
Lowell	8.1	51.2	25.5
Billerica	6.2	57.4	19.3
Burlington	5.5	62.9	13.8
Arlington	7.4	70.3	6.4
Porter Square...	2.6	72.9	3.8
Cambridge	1.0	73.9	2.8
Boston	2.8	76.7	0.0

TWO DAYS ON LONG ISLAND.

Forty-Eight Hour Trip on the Millionaires' Playground—Through a Land of Palatial Residences and Shore Resorts.

LONG ISLAND is not considered a touring ground by people in the eastern states, but everyone who visits New York City on an automobile run usually takes the short two-day trip along this interesting strip of land, which lays out in the ocean off the southern shores of New England. While it does not present the grandeur of the West or the woodland and mountain spectacles of the northern New England states, it has a charm of its own, the entire island being dotted with beautiful golf courses, palatial residences and estates and magnificent driveways, both public and private.

The tourist leaves New York over the Queensborough bridge, directly east from Columbus circle. The centre of the bridge rests on Blackwell's island and the

myriad summer resorts beyond are Westhampton beach and Canoe place. This latter will be identified by a wooden image in front of the village inn.

Crossing a canal the road runs to Shinnecock Hills. There is a large and finely equipped golf club here and the road passes the outskirts of the reservation of the Shinnecock Indians. Lake Agawam is a very beautiful sheet of water near Southampton and it is well worth while for the tourists to make the short run about the roads along its shores.

There are many picturesque windmills here. Almost every foot of the territory has been pictured by the landscape artists of New York and hundreds of places will be recognized by those who are familiar with the American

The island is a little more than 200 miles in circumference, as the road goes so that it provides two days of excellent driving. The roads are as good as can be found anywhere, hard, smooth and amply wide. They are made chiefly of macadam, gravel and shell. One of the curiosities of the run is Nicola Tesla's great experimental electrical tower. At Port Jefferson a ferry is available to Bridgeport.

ITINERARY. AROUND LONG ISLAND.

Night Stops—Greenport, New York.
Two Days, 218.5 Miles.

New York City—Greenport,
115.1 Miles.

	Miles to	Total Miles Out Return
Long Island City	0.0	0.0 115.1
Jamaica	8.8	8.8 106.3
Springfield	2.9	11.7 103.4
Valley Stream	2.7	14.4 100.7
Lynbrook	1.9	16.3 98.8
Rockville Center	1.3	17.6 97.5
Baldwin	1.9	19.5 95.6
Freeport	1.7	21.2 93.9
Merrick	1.6	22.8 92.3
Amityville	7.2	30.0 85.1
Babylon	5.5	35.5 79.6
Bay Shore	4.8	40.3 74.8
Islip	1.8	42.1 73.0
Oakdale	4.9	47.0 68.1
Sayville	3.1	50.1 65.0
Bayport	1.5	51.6 63.5
Blue Point	1.7	53.3 61.8
Patchogue	1.8	55.1 60.0
Bellport	4.3	59.4 55.7
Moriches	7.8	67.2 47.9
East Port	6.6	73.8 41.3
West Hampton		
Beach	5.4	79.2 35.9
Quogue	3.1	82.3 32.8
Good Ground	7.3	89.6 25.5
Southampton	6.1	95.7 19.4
Bridgehampton	6.3	102.0 13.1
Sag Harbor	5.3	107.3 7.8
Shelter Island	5.5	112.8 2.3
Greenport Ferry	2.2	115.0 0.1
Greenport	0.1	115.1 0.0

Greenport—New York City,
103.4 Miles.

	Miles to	Total Miles Out Return
Greenport	0.0	0.0 103.4
Southold	4.7	4.7 98.7
Peconic	3.3	8.0 95.4
Cutchogue	1.7	9.7 93.7
Mattituck	3.0	12.7 90.7
Jamestown	4.0	16.7 86.7
Riverhead	5.4	22.1 81.3
Wading River	11.0	33.1 70.3
Miller's Place	8.6	41.7 61.7
Port Jefferson	4.7	46.4 57.0
E. Setauket	1.8	48.2 55.2
Stony Brook	3.5	51.7 51.7
St. James	2.3	54.0 49.4
Commack	8.3	62.3 41.1
Northport	3.9	66.2 37.2
Centerport	3.2	69.4 34.0
Huntington	3.2	72.6 30.8
E. Norwich	6.4	79.0 24.4
Roslyn	6.8	85.8 17.6
Manhasset Hills	2.9	88.7 14.7
Little Neck	2.7	91.4 12.0
Bayside	1.9	93.3 10.1
Flushing	3.5	96.8 6.6
Corona	1.9	98.7 4.7
Long Island City	4.7	103.4 0.0



Montauk Light, Eastern Extremity of Island.

prison buildings are visible just below on either side. The tourist descends the long approach into Long Island city and here the route, as given, begins.

It goes through Jamaica, a flourishing town in the borough of Queens, and then out through Freeport and Babylon. The next town is Bay Shore, a fashionable watering place, from which steamers may be taken to Fire Island. From here on, fine estates, many of them very large and of great value, are passed.

Patchogue is one of the most populous of the summer cities on the island. Thousands come here every year for their summer vacations. Along the shore the road passes Blue Point, famous for its oyster grounds, and among the

art of the last half century.

Easthampton was the home of John Howard Payne and Dr. Lyman Beecher. If the tourist desires, a side trip may be made to Montauk Point, another famous resort. At Sag Harbor a ferry is taken to Shelter Island, upon which there are many very beautiful drives. From Shelter Island heights another ferry carries the tourist to Greenport, the end of the day's run. From Sag Harbor, Shelter Island and Greenport boats are available to New London or Bridgeport.

The road goes west, passing within a mile of the shore of Great Peconic bay, and at Riverhead goes through a quaint little park with an interesting water tower.

ALONG THE JERSEY COAST.

From New York to Philadelphia Through Atlantic City, Cape May and Other Summering Places in the State of New Jersey.

ANOTHER tour of a character similar to the Long Island route is that from New York down the Jersey coast to Cape May, thence northward to Philadelphia. While not the shortest route to Cape May and Atlantic City, the itinerary includes the famous summer resorts along the New Jersey seacoast.

The tourist may leave New York by crossing into New Jersey and running through Newark, Elizabeth and Perth Amboy to South Amboy or he may go by ferry to Staten Island, across that island, and by ferry again to South Amboy.

From South Amboy the route follows the shores of Raritan bay to Keyport. Near Freehold is an imposing granite monument, commemorating the Battle of Mon-

many fine walks through the woods and two beautiful lakes, Carylajo and Maneta. There are many great estates in the neighborhood. The famous Lakewood links are laid out on the grounds of Georgian court, the estate of George Gould.

Atlantic City, the greatest of all American summer resorts, which often on busy days in the middle of the summer entertains as many as 300,000 visitors, is on Absecon Island, separated from the mainland by a string of salt marshes. It has nearly 1000 hotels. Besides the world famous board walk, there are five great piers. Cape May has board walks and amusement piers. This also is one of the favorite gathering places for pleasure seekers from New York City.

Asbury Park....	1.2	64.3	89.2
Ocean Grove.....	0.9	65.2	88.3
Bradley Beach....	0.5	65.7	87.8
Avon	1.0	66.7	86.8
Belmont	0.7	67.4	86.1
Spring Lake.....	1.6	69.0	84.5
Seagirt	1.7	70.7	82.8
Mansquan	1.0	71.7	81.5
Brielle	1.0	72.7	80.8
Pt. Pleasant.....	1.6	74.3	79.2
Burrville	4.4	78.7	74.8
Lakewood	5.3	84.0	69.5
Toms River	10.0	94.0	59.5
Bayville	4.4	98.4	55.1
Barnegat	12.0	110.4	43.1
Manahawken	4.8	115.2	38.3
Tuckerton	7.7	122.9	30.6
New Gretna	6.7	129.6	23.9
Port Republic....	6.7	136.3	17.2
Oceanville	4.4	140.7	12.8
Absecon	3.5	144.2	9.3
Atlantic City....	9.3	153.5	0.0

Atlantic City-Cape May, 48.1 Miles.

	Miles to	Total Miles
	Out	Return
Atlantic City....	0.0	0.0
Pleasantville	5.3	5.3
Ocean City.....	9.6	14.9



Bathing Beach at Atlantic City, Where Thousands of People Enjoy the Surf Every Day.

mouth, fought June 28, 1778.

Red Bank, on the Navesink river, is a famous rendezvous for yachtsmen. Long Branch was once one of the most famous watering resorts in America. It derives its name from the "long branch" of the Shrewsbury river which enters the sea nearby.

Its rise to great fame was due partly to the fact that during President Grant's administration it was the summer capital. President Garfield died in his cottage at Elberton, near by. Asbury park is another very well known summer resort and not far from it is Ocean Grove, which is also well known.

Lakewood is a very popular summer and winter resort among the New Jersey pines. There are

ITINERARY. NEW YORK-PHILADELPHIA.

Night Stops—New York City, Atlantic City and Cape May, N. J.; Philadelphia, Penn. Three Days, 288.1 Miles.

New York-Atlantic City, 153.5 Miles.

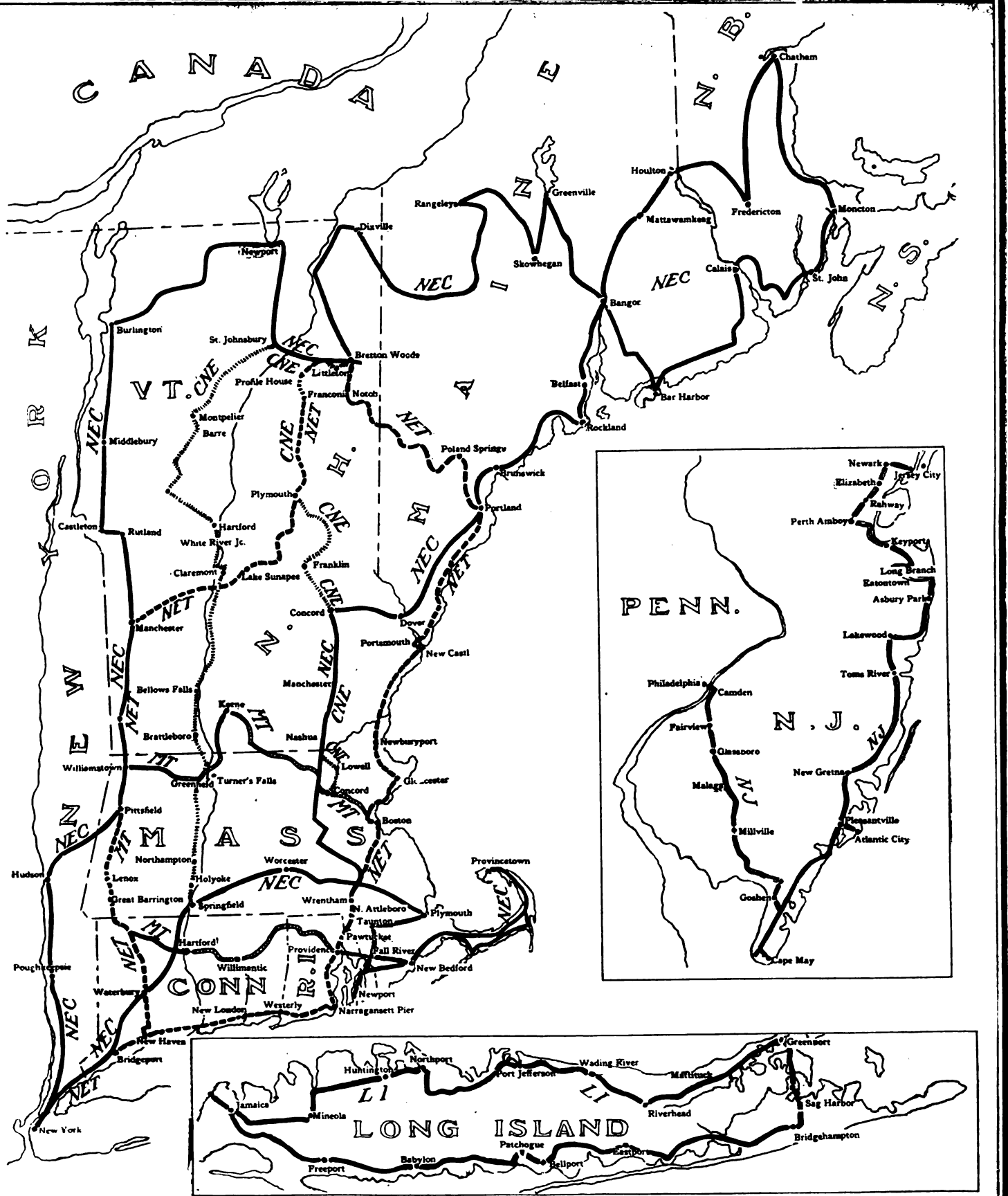
	Miles to	Total Miles
	Out	Return
New York	0.0	0.0
Newark	8.9	8.9
Elizabeth	6.2	15.1
Rahway	5.6	20.7
Perth Amboy....	7.5	28.2
South Amboy....	4.1	32.3
Keyport	6.0	38.3
Middletown	6.1	44.4
Red Bank	4.9	49.3
Shrewsbury	1.9	51.2
Eatontown	1.6	52.8
Long Branch....	4.6	57.4
West End	1.6	59.0
Elberon	1.7	60.7
Deal	1.4	62.1
Allenhurst	1.0	63.1

Seaville	9.7	24.6
Ocean View Station	2.2	26.8
Cape May Court-house	8.8	35.6
Rio Grande	5.9	41.5
Cape May	6.6	48.1

Cape May-Philadelphia, 85.5 Miles.

	Miles to	Total Miles
	Out	Return
Cape May	0.0	0.0
Cape May Court-house	13.1	13.1
Dennisville	8.9	22.0
Eldora	5.0	27.0
Leesburg	6.2	33.2
Mauricetown	4.1	37.3
Millville	9.5	46.8
Vineland	6.5	53.3
Malaga	5.7	59.0
Franklinville	3.4	62.4
Clayton	2.6	65.0
Glassboro	2.7	67.7
Hurville	4.6	72.3
Westville	7.7	80.0
Gloucester	0.9	80.9
Camden	4.6	85.5
Philadelphia	0.0	85.5

Atlantic Coast Motor Car Tours.



NET—New England Tour.
MT—Mohawk Trail.

NEC—New England-Canada.
NJ—New Jersey Tour.

CNE—Central New England.
LI—Long Island Tour.

ALONG THE ST. LAWRENCE RIVER.

Ideal Midsummer or Early Fall Tour from Maine Through Canada to Lake Champlain, Lake George and the Military Camp at Plattsburg.

AN IDEAL mid-summer or early fall tour includes an itinerary leading north through Maine from Portland to Quebec, thence down the St. Lawrence river on the north shore to Montreal and returning southward on the western side of Lake Champlain to Lake George.

The variety of the scenery afforded by this route is unexcelled, trailing out as it does through forest, field and mountains, winding along the Great St. Lawrence and down through New York state's magnificent lake country.

From Portland, where the start is made, the route runs north through Brunswick to Augusta, which is at the head of navigation for small ships on the Kennebec. The city lies on both sides of the river. The road runs directly up the river to Waterville, the seat of Colby university, where, on the campus nestling among the trees, is an unusual monument to the students of the college who fell in the civil war.

The woods beyond Waterville become very thick and the country very wild. Moose and caribou abound here. For a few miles near the international boundary line the road is rough and dangerous, but elsewhere it is newly improved and excellent both in Quebec and in Maine.

Some very charming views of the Chaudiere valley and of the Laurentide mountains in the distance are obtainable. The French villages, which one begins to encounter directly the Canadian line is crossed, are very picturesque and interesting. Hotel accommodations, however, are not good.

Quebec itself is a city of great beauty and historic significance.

From Quebec the road to Montreal lies along the north shore of the St. Lawrence river all the way. It crosses the Jacques Cartier river, famous for its salmon, not far from Quebec, and the St. Anne river at Portneuf. The St. Lawrence is in full view for the first half of the route and many small streams which empty into it are crossed along the way.

Three Rivers is the largest town between the two cities. It was built in 1634 and lies at the mouth of the St. Maurice river, at the head of tidewater on the St. Lawrence. There is a hotel here and garages, as well as an impressive cathedral. Near Louiseville are the St. Leon springs, a popular watering place. At Berthier the St. Lawrence expands

into a large lake, which is known as Lake St. Peter. It is 25 miles long and about nine miles wide.

There are many of the famous islands of the St. Lawrence near Berthier. At the mouth of the Riviere des Prairies is the quaint old village of L'Assomption. There are valuable mineral springs near here, at Varennes, which are much visited by people from Montreal. At Boucherville are many low, marshy islands, where there is a great deal of duck shooting in season, and where many ice jams form at the break up of winter.

Montreal is the largest and one of the most interesting cities of Canada. It was settled by the French early in the 17th century.

From Montreal the route goes southwest following the direction

and Taylor-on-Schroon. Schroon lake has an elevation of 807 feet above the sea level.

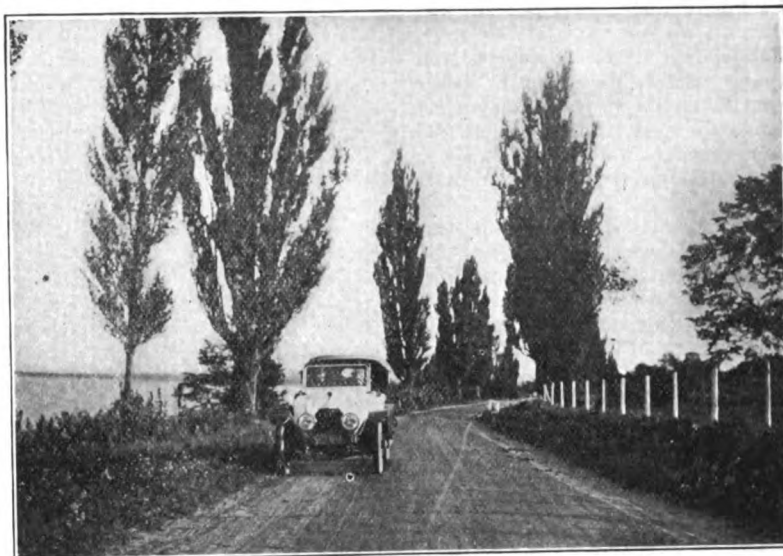
Chesterton is a beautiful hamlet on Loon lake, a very pretty little sheet of water, and then the road comes to Lake George, which is of considerable size, as well as rare scenic attractiveness.

ITINERARY. PORTLAND-LAKE GEORGE.

Night Stops—Portland, Augusta, Me.; Quebec, Montreal, P. Q.; Elizabethtown, N. Y. Five Days, 578.4 Miles.

Portland-Augusta, 64.8 Miles.

	Miles to	Total Miles	Out Return
Portland	0.0	0.0	64.8



Lake Shore Road Between Lake George and Plattsburg.

taken by the Richelieu river through Chambly to Rouses Point on the international boundary line. It runs south to Plattsburg, on Lake Champlain, where there is an important United States army post and runs parallel with the shore line of Lake Champlain for a considerable distance, affording some very fine scenery.

Some of the finest country in New York State from a scenic point of view is encountered on the short run from Elizabethtown to the town of Lake George. Out of Elizabethtown the road follows the valley of the Boquet river. Then the Schroon river valley is taken up and followed to Schroon lake and along the border of this charming sheet of water, through Schroon Lake village

Morill's Corners	3.1	3.1	61.7
Allen's Corner	0.9	4.0	60.8
Gray	13.1	17.1	47.7
North Gray	2.4	19.5	45.3
Upper Gloucester	5.3	24.8	40.0
Auburn	8.7	33.5	31.3
Lewiston	0.4	33.9	30.9
Greene	8.0	41.9	22.9
Winthrop	12.5	54.4	10.4
Manchester	5.9	60.3	4.5
Augusta	4.5	64.8	0.0

Augusta-Lake Parlin, 97 Miles.

	Miles to	Total Miles	Out Return
Augusta	0.0	0.0	97.0
Waterville	19.6	19.6	77.4
Fairfield Center	4.1	23.7	73.3
Skowhegan	12.3	36.0	61.0
Lakewood	5.7	41.7	55.3
Solon	8.4	50.1	46.9
Bingham	8.5	58.6	38.4
Carratunk	15.3	73.9	23.1
The Forks	7.4	81.3	15.7
Lake Parlin	15.7	97.0	0.0

Lake Parlin-Quebec, 121 Miles.

	Miles to	Total Miles	Out Return
Lake Parlin.....	0.0	0.0	121.0
Jackman, Me.....	12.7	12.7	108.3
Moose River, Me. 1.5	14.2	14.2	106.8
Line House.....	14.2	28.4	92.6
Armstrong, P. Q. 11.0	39.4	39.4	81.6
Jersey.....	16.7	56.1	64.9
St. George.....	1.9	58.0	63.0
Gilbert.....	7.0	65.0	56.0
Beauceville.....	2.9	67.9	53.1
Des Plantes.....	3.5	71.4	49.6
St. Joseph.....	6.4	77.8	43.2
Beauce Junction 5.3	83.1	83.1	37.9
Ste. Marie.....	7.0	90.1	30.9
Scott Junction... 5.1	95.2	95.2	25.8
St. Henri.....	14.7	109.9	11.1
Levin-Quebec			
Ferry.....	10.7	120.6	0.4
Quebec.....	0.4	121.0	0.0

Quebec-Montreal, 176.7 Miles.

	Miles to	Total Miles	Out Return
Quebec.....	0.0	0.0	176.7
St. Augustin.....	14.3	14.3	162.4
Les Ecurieulls.....	14.2	28.5	148.2
Cap Sante.....	4.2	32.7	144.0

Portneuf.....	5.1	37.8	138.9
Deschambault...	4.2	42.0	134.7
La Chevrotiere...	4.8	46.8	129.9
Grondines.....	2.3	49.1	127.6
Ste Anne De La			
Perade.....	8.8	57.9	118.8
Champlain.....	8.1	66.0	110.7
Cap de la Made-			
leine.....	9.7	75.7	101.0
Three Rivers...	3.9	79.6	97.1
Pointe du Lac...	9.1	88.7	88.0
Yamachiche.....	8.3	97.0	79.7
Maskinonge.....	14.1	111.1	65.6
Berthier.....	14.2	125.3	51.4
Lanorale.....	9.2	134.5	42.2
Lavaltrie.....	6.1	140.6	36.1
St. Sulpice.....	5.7	146.3	30.4
L'Assomption...	5.2	151.5	25.2
Charlemagne....	8.7	160.2	16.5
Montreal.....	16.5	176.7	0.0

Montreal-Elizabethtown, 118.9 Miles.

	Miles to	Total Miles	Out Return
Montreal.....	0.0	0.0	118.9
Longueuil Ferry 2.2	2.2	2.2	116.7
Longueuil.....	0.8	3.0	115.9

St. Hubert.....	5.0	8.0	110.9
Chambly.....	8.9	16.9	102.0
St. Johns, P. Q. 11.4	28.3	28.3	90.6
Rouse's Point ..24.1	52.4	52.4	66.5
Champlain.....	5.1	57.5	61.4
Beekmantown ..17.1	74.6	74.6	44.3
Plattsburg.....	6.6	81.2	37.7
Keeseville.....	15.8	97.0	21.9
Elizabethtown ..21.9	118.9	118.9	0.0

Elizabethtown-Lake George, 69.3 Miles.

	Miles to	Total Miles	Out Return
Elizabethtown...	0.0	0.0	69.3
Schroon River...22.6	22.6	22.6	46.7
Schroon Lake... 9.1	31.7	31.7	37.6
Taylor's-on-			
Schroon.....	5.6	37.3	32.0
Pottersville.....	3.9	41.2	28.1
Loon Lake.....	4.9	46.1	23.2
Chesterstown....	4.0	50.1	19.2
Warrenburg.....	12.7	62.8	6.5
Lake George.....	6.5	69.3	0.0

CIRCLING LAKE ONTARIO.

A TOURING route around Lake Ontario and along the lower St. Lawrence is not only an excellent trip in itself, but can be made as an extension of either the Portland-Montreal-Lake George tour or, in fact, any of the tours that lead to either Albany or Montreal. Following Lake Ontario from Kingston to Hamilton on the Canadian side the route swings back through Niagara Falls, eastward through New York state to Albany.

The first day's run is from Montreal to Ottawa. There is another road in somewhat better condition straight down the St. Lawrence river, but this does not touch Ottawa, which is the capital of Canada, and holds large interest for the visitor. Neither road is satisfactory in wet weather, as the ground is clay and if the tourist should strike this point after prolonged rains it is best to ship the car by boat to Kingston and resume the tour there.

The way leads across the island

of Montreal and then across the Isle of Jesus, after which it circles the shore of the Lake of Two mountains to St. Andrews on the River Du Nord. It goes through Carillon and crosses the Ottawa river at Point Fortune, following the southern shore of this river to Little Rideau and L'Original.

Here it turns back into the country from the river through the towns of Alfred and Plantagenet and back again to the Ottawa at Wendover, skirting the river again to Clarence, Rockland and Orleans.

The next day the route leads almost directly south toward the states and is very much better than that travelled the day before. The St. Lawrence is reached at Morrisburg and along the river, the route runs to Prescott. This is directly opposite Ogdensburg, N. Y.

Further down the north shore of the river at Brockville there is another ferry to Morristown, N. Y. The road for a space here runs

a distance back from the river, although the Thousand Islands are to be seen from time to time and at Gananoque the tourist comes in full sight of them. The Rideau river is crossed in Kingston, which is the stop for the night.

The next day's route follows the north shore of Lake Ontario all the way to Toronto. Many splendid views of the lake are to be had from the road and the towns along the way are large enough to furnish supplies for man and car.

The next day's route goes through Hamilton, Ont., a thriving modern industrial city, and ends at Niagara Falls, perhaps the best known natural wonder on the American continent. The points of interest here are the falls themselves, a sheer drop of the Niagara river on its way from Lake Erie to Lake Ontario.

Fully as interesting as the falls themselves are the rapids below them, where the water roars and



The Thousand Islands in the St. Lawrence River.

tumbles at terrific speed over submerged rocks. The great fall of water has worn away the face of the rock a few inches every year and since prehistoric times the great falls have moved gradually but surely upstream.

It is a short trip of only 20 miles over good roads to Buffalo. This city is an important centre of east and west bound traffic. The tourist from the east can easily pick out a route into the middle west from Buffalo and the westerner here finds himself at the gateway of the marvelous touring country of New York and New England.

From Buffalo to Syracuse the route leads through the well known Montezuma swamps, through which passage is difficult in wet weather. This stretch of road is between Montezuma and Port Byron.

The points of interest along the way include the home of Joseph Smith at Palmyra. Smith was the founder of Mormonism and it was here that he claimed to have discovered the golden plates of the book of Mormon. Not far away is the village of Hydesville, where the Fox sisters lived. They had a large part in establishing the doctrines and practises of spiritualism.

Three miles north of Oneida, N. Y., is the famous Oneida community, which has been in existence since 1847. Southward is the Oneida Indian reservation, from which excellent views of Oneida lake may be obtained. Auburn is the site of a famous New York state's prison, and Syracuse and Utica are well known industrial cities. Schenectady is the seat of the great works of the General Electric Company.

ITINERARY. MONTREAL-ALBANY.

Night Stops—Montreal, Ottawa, Kingston, Toronto, Can.; Buffalo, Syracuse and Albany, N. Y.
Six Days, 846.2 Miles.

Montreal-Ottawa, 121 Miles.

	Miles to	Total Miles	Out Return
Montreal	0.0	0.0	121.0
St. Laurent	6.9	6.9	114.1
Borde a Plouffe	4.1	11.0	110.0
St. Martin	1.6	12.6	108.4
St. Eustace	7.9	20.5	100.5
St. Benoit	11.3	31.8	89.2
St. Placide	6.4	38.2	82.8
St. Andrews East	8.4	46.6	74.4
Carrillon	2.2	48.8	72.2
Ferry to Point Fortune.			
Little Rideau	5.4	54.2	66.8
Hawkesbury	7.7	61.9	59.1
L'Original	3.1	65.0	56.0
Canbura	2.5	67.5	53.5
Alfred	10.0	77.5	43.5
Plantagenet	7.0	84.5	36.5
Wendover	6.0	90.5	30.5
Clarence	5.5	96.0	25.0
Rockland	2.5	98.5	22.5
Cumberland	5.0	103.5	17.5
Orleans	7.0	110.5	10.5
Ottawa	10.5	121.0	0.0

Ottawa-Kingston, 132.5 Miles.

	Miles to	Total Miles	Out Return
Ottawa	0.0	0.0	132.5
S. Gloucester	13.0	13.0	119.5
Metcalf	4.0	17.0	115.5
Ormond	8.0	25.0	107.5
Winchester	4.0	29.0	103.5
Cass Bridge	3.5	32.5	100.0
Williamsburg	8.5	41.0	91.5
Morrisburg	6.0	47.0	85.5
Iroquois	6.0	53.0	79.5
Cardinal	5.5	58.5	74.0
Prescott	9.6	68.1	64.4
Brockville	12.2	80.3	52.2
Lyn Village	6.3	86.6	45.9
Gananoque	27.3	113.9	18.6
Kingston	18.6	132.5	0.0

Kingston-Toronto, 165 Miles.

	Miles to	Total Miles	Out Return
Kingston	0.0	0.0	165.0
Cataraqui	3.6	3.6	161.4
Napanee	21.9	25.5	139.5
Maryville	8.4	33.9	131.1
Shannonville	6.7	40.6	124.4
Belleville	8.8	49.4	115.6
Trenton	11.3	60.7	104.3
Brighton	9.4	70.1	94.9
Colborne	8.3	78.4	86.6
Grafton	7.8	86.2	78.8
Cobourg	7.6	93.8	71.2

Niagara Falls, N. Y.	1.0	98.5	21.6
Echota Station	2.5	101.0	19.1
La Salle	3.0	104.0	16.1
N. Tonawanda	6.2	110.2	9.9
Tonawanda	0.4	110.6	9.5
Buffalo	9.5	120.1	0.0

Buffalo-Syracuse, 162 Miles.

	Miles to	Total Miles	Out Return
Buffalo	0.0	0.0	162.0
Williamsville	9.8	9.8	152.2
Clarence	8.3	18.1	143.9
Pembroke	7.9	26.0	136.0
East Pembroke	6.6	32.6	129.4
Batavia	6.6	39.2	122.8
Byron	9.8	49.0	113.0
Bergen	6.6	55.6	106.4
Churchville	3.4	59.0	103.0
North Chili	4.4	63.4	98.6
Rochester	10.4	73.8	88.2
Brighton	3.2	77.0	85.0
Fairport	6.8	83.8	78.2
Macedon	8.3	92.1	69.9
Yellow Mills	2.7	94.8	67.2
Palmyra	1.2	96.0	66.0
East Palmyra	4.9	100.9	61.1
Newark	4.6	105.5	56.5
Lyons	6.1	111.6	50.4
Lock Berlin	4.2	115.8	46.2
Clyde	4.4	120.2	41.8
Savannah	6.4	126.6	35.4
Montezuma	5.4	132.0	30.0



Looking on Niagara Falls from Canadian Side.

Port Hope	7.4	101.2	63.8
Welcome	3.1	104.3	60.7
Newcastle	13.3	117.6	47.4
Boumanville	5.2	122.8	42.2
Oshawa	9.4	132.2	32.8
Whitby	4.2	136.4	28.6
Pickering	6.1	142.5	22.5
Liverpool	2.3	144.7	20.3
Riverdale	18.5	163.2	1.8
Toronto	1.8	165.0	0.0

Toronto-Buffalo, 120.1 Miles.

	Miles to	Total Miles	Out Return
Toronto	0.0	0.0	120.1
Cookville	16.3	16.3	103.8
Erindale	3.3	19.6	100.5
Trafalgar Village	5.1	24.7	95.4
Appleby	10.3	35.0	85.1
Freeman	3.8	38.8	81.3
Aldershot	2.8	41.6	78.5
Hamilton	5.4	47.0	73.1
Stony Creek	6.7	53.7	66.4
Winona	5.6	59.3	60.8
Grimsby	5.1	64.4	55.7
Beamsville	4.9	69.3	50.8
Vineland	4.2	73.5	46.6
Jordan	1.8	75.3	44.8
St. Catharines	7.1	82.4	37.7
Homer	3.3	85.7	34.4
St. David	4.9	90.6	29.5
Stamford	2.1	92.7	27.4
Niagara Falls, Ont.	4.8	97.5	22.6

Port Byron	4.6	136.6	25.4
Weedsport	3.5	140.1	21.9
Elbridge	6.4	146.5	15.5
Camillus	7.2	153.7	8.3
Syracuse	8.3	162.0	0.0

Syracuse-Albany, 145.6 Miles.

	Miles to	Total Miles	Out Return
Syracuse	0.0	0.0	145.6
Fayetteville	7.6	7.6	138.0
Mycenae	4.5	12.1	133.5
Sullivan	4.3	16.4	129.2
Canastota	5.1	21.5	124.1
Wampsville	2.3	23.7	121.9
Oneida	3.4	27.1	118.5
Oneida Castle	1.4	28.5	117.1
Vernon	5.2	33.7	111.9
Kirkland Village	8.3	42.0	103.6
New Hartford	5.1	47.1	98.5
Utica	3.5	50.6	95.0
Deerfield	1.4	52.0	93.6
West Schuyler	1.0	53.0	92.6
Ilion	10.4	63.4	82.2
Herkimer	2.7	66.1	79.5
Little Falls	7.3	73.4	72.2
St. Johnsville	10.5	83.9	61.7
Palatine Bridge	8.8	92.7	52.9
Yost's Station	6.2	98.9	46.7
Fonda	5.3	104.2	41.4
Alken	7.7	111.9	33.7
Amsterdam	3.0	114.9	30.7
Scotia	14.1	129.0	16.6
Schenectady	1.6	130.6	15.0
Albany	15.0	145.6	0.0

THROUGH THE EASTERN MOUNTAINS.

Summer Touring Through the Alleghenies, Catskills and Adirondack Mountains and New York's Lake Region.

THE eastern mountainous country, through the northern border of Pennsylvania, the Adirondack mountains and the Catskills, winding along the Hudson valley in New York state, is one of the most attractive tours of the East. After leaving the Alleghenies the route passes up through that section of New York state which has been made famous by two of America's greatest authors, Washington Irving and James Fenimore Cooper. It is a trip teeming with interest for anyone who has studied the works of either of these writers and also presents wonderful scenic effects.

The trip begins in New York City, which the tourist leaves by way of the Weehawken ferry at Forty-second street. It goes through Jersey City and over fine macadam to Newark. Madison is the seat of the Drew Theological

cite mining regions and from the road many mines and coal breakers can be seen. Out of Scranton the road leads through valleys with fine mountains on every side. There are many creeks and some well kept and attractive farms. At Hallstead the Susquehanna river is crossed and the road leads into New York state. Shortly beyond this an excellent macadam road begins, which covers the remaining distance into Binghamton.

For about 20 miles out of Binghamton the road follows the beautiful Susquehanna valley and then turns north. The change in the agricultural aspect of the country is immediately apparent. There are evidences of rural prosperity on every side. Over fine dirt roads the tourist goes to Montour Falls and enters the basin of Seneca lake, a sparkling and beautiful sheet of water. There is

skirts the shores of Otsego lake and then cuts across the hills to the Mohawk valley at Fort plain. From here the run goes down this remarkably beautiful valley. Leaving the valley the road goes up a steep hill toward Ballston Spa and from that point a good macadam road runs to Saratoga, one of the most famous resorts in the country. From here a short run brings the tourist to Lake George, one of the most charming of American lakes.

The next day takes the motorist back over the previous day's run as far as Saratoga and Ballston, and thence through Burnt Hills and Schenectady to Albany. From Albany the tourist goes through Rensselaer, with its magnificent estates, and arrives shortly at Kinderhook.

The road passes through Red Hook, which is within five miles of the spot where Fulton built the "Clermont." Entering Poughkeepsie the road passes many fine estates—the home of F. W. Vanderbilt, the residence of John Burroughs, the famous naturalist, the estate of William B. Dinsmore, who was formerly president of the Adams Express Company, and the estate of John Jacob Astor.

From the top of a hill up which a cable railroad runs at Fishkill Landing a superb view of the Hudson and the Catskills is obtainable. At Garrison one may take a ferry to West Point, the seat of the United States military academy.



Delaware Water Gap in the Kittatiny Mountains on Delaware River.

seminary, which has been an important institution since 1857.

Morristown, N. J., passed on the first day, is chiefly known as having been the winter quarters of General Washington during the winter of 1779-80.

Shortly out of Morristown the road ascends Schooley's mountain, which was once a popular summer resort, overlooking the Musconetcong and German valleys. Crossing the Delaware on a ferry near Hackettstown, the road follows the river north into Delaware Water Gap.

From the gap the road leads to the summit of Mt. Pocono and across the Pocono mountain plateau. Beyond this the descent of the Alleghenies is made and the road enters Scranton over a fine boulevard. Scranton is a city in the centre of the great anthra-

good macadam from that point to Watkins Glen, which is nationally famous for its scenic beauty.

Crossing the lake inlet near Watkins village the route runs up Rock Cabin road. As a hill is ascended, red and white marks painted on the cliffs are noted. This indicates a surveyor's mark. With this point as a basis all the surveys in this part of New York have been made since early times. The road passes through the grounds of Cornell university at the head of Cayuga lake in Ithaca. For the rest of the day the route goes through fine farming country. The Unadilla river is crossed and the route goes along the south shore of Canandarago lake, and runs through the basin of Otsego lake.

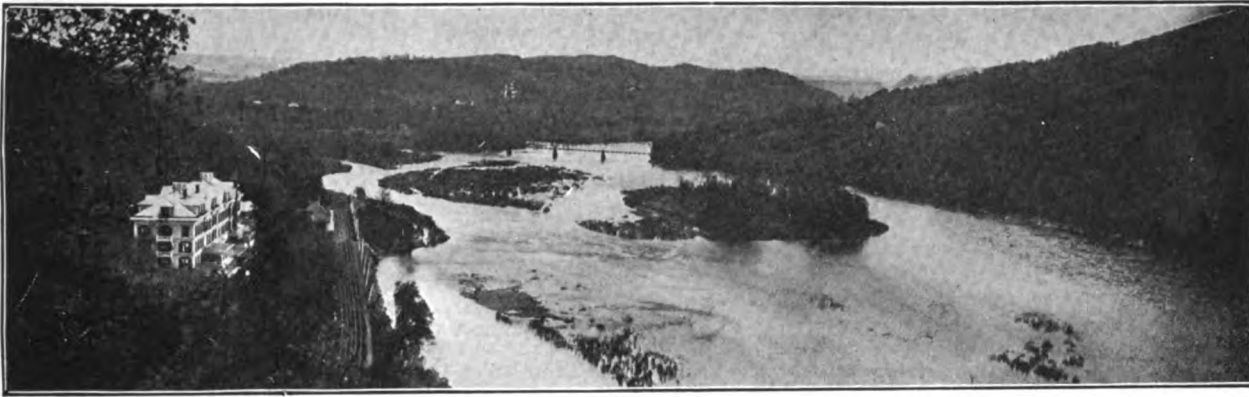
Cooperstown is at the end of Otsego lake. The next day the route

ITINERARY. EASTERN MOUNTAINS.

Night Stops—Delaware Water Gap, Penn.; Watkins, Cooperstown, Sagamore, Albany and New York. Seven Days, 730.8 Miles.

New York-Delaware Water Gap, 80.9 Miles.

	Total Miles	
	Miles to	Out Return
Weehawken Ferry	0.0	0.0
Newark	10.6	70.3
Irvington	2.3	68.0
Madison	11.0	57.0
Morristown	6.3	50.7
Mendham	6.9	43.8
Chester	5.6	38.2
German Valley	4.7	33.5
Hackettstown	6.4	27.1
Vienna	3.9	23.2
Danville	1.5	21.7
Buttsville	6.3	15.4
Bridgeville	1.2	14.2
Delaware	5.6	8.6
Myers Ferry	0.4	8.2
Portland, Penn.	2.9	5.3



Banks of Delaware River in Pennsylvania.

Delaware Water Gap 5.3 80.9 0.0

Delaware Water Gap-Binghamton, 112 Miles.

	Total Miles	Miles to	Out Return
Delaware Water Gap 0.0	0.0	112.0	
Stroudsburg 3.6	3.6	108.4	
Mt. Pocono 16.3	19.9	92.1	
Tobyhanna 5.0	24.9	87.1	
Gouldsboro 5.6	30.5	81.5	
Scranton 22.2	52.7	59.3	
Providence 2.8	55.5	56.5	
Clark's Summit .. 4.8	60.3	51.7	
Wallaville 6.5	66.8	45.2	
Glenwood 6.3	73.1	38.9	
Hartford 10.3	83.4	28.6	
New Milford 7.2	90.6	21.4	
Broad Bend, Penn. 6.8	97.4	14.6	
Kirkwood, N. Y. 5.6	103.0	9.0	
Binghamton 9.0	112.0	0.0	

Binghamton-Watkins Glen, 70.1 Miles.

	Total Miles	Miles to	Out Return
Binghamton 0.0	0.0	70.1	
Vestal 10.3	10.3	59.8	
Owego 14.3	24.6	45.5	
Candor 10.5	35.1	35.0	
Van Etten 11.9	47.0	23.1	
Cayuta 9.9	56.9	13.2	
Alpine 3.0	59.9	10.2	
Odessa 4.1	64.0	6.1	
Watkins Glen... 6.1	70.1	0.0	

Watkins Glen-Cooperstown, 126.2 Miles.

	Total Miles	Miles to	Out Return
Watkins Glen... 0.0	0.0	126.2	
Montour Falls... 2.8	2.8	123.4	
Odessa 3.2	6.0	120.2	
Alpine 3.9	9.9	116.3	
Ithaca 17.8	27.7	98.5	
Varna 3.9	31.6	94.6	
Willow Glen 5.2	36.8	89.4	
Dryden 2.5	39.3	86.9	
Cortland 10.1	49.4	76.8	
Truxton 11.4	60.8	65.4	
De Ruyter 8.2	69.0	57.2	
Ostello 10.6	79.6	46.6	
Smyrna 8.6	88.2	38.0	
Edmeston 18.0	106.2	20.0	
Burlington 6.7	112.9	13.3	
Fly Creek 7.6	120.5	5.7	
Cooperstown 5.7	126.2	0.0	

Cooperstown-Sagamore, 120.4 Miles.

	Total Miles	Miles to	Out Return
Cooperstown 0.0	0.0	120.4	
Springfield 10.3	10.3	110.1	
Cherry Valley .. 6.6	16.9	103.5	
Sharon Springs.. 7.6	24.5	95.9	
Ames 3.7	28.2	92.2	
Canajoharie 6.5	34.7	85.7	
Palatine Bridge. 0.5	35.2	85.2	
Fonda 11.4	46.6	73.8	
Tribes Hill 8.9	55.5	64.9	
Amsterdam 1.8	57.3	63.1	
Ballston 22.2	79.5	40.9	
Saratoga 6.7	86.2	34.2	
S. Glens Falls... 18.4	104.6	15.8	
Glens Falls 0.7	105.3	15.1	
Lake George ... 9.1	114.4	6.0	
Sagamore, N. Y. 6.0	120.4	0.0	

Sagamore-Albany, 71.9 Miles.

	Total Miles	Miles to	Out Return
Sagamore 0.0	0.0	71.9	
Lake George 6.0	6.0	65.9	
Glens Falls 9.2	15.2	56.7	
S. Glens Falls... 0.7	15.9	56.0	
Saratoga 18.4	34.3	37.6	
Ballston 6.7	41.0	30.9	
Burnt Hills 7.6	48.6	23.3	
Schenectady 8.3	56.9	15.0	
Albany 15.0	71.9	0.0	

Albany-New York City, 149.3 Miles.

	Total Miles	Miles to	Out Return
Albany 0.0	0.0	149.3	
Rensselaer 1.0	1.0	148.3	
Schodack Center 6.2	7.2	142.1	
Kinderhook 13.4	20.6	128.7	
Stuyvesant Falls 3.8	24.4	124.9	
Stockville 5.3	29.7	119.6	
Hudson 3.4	33.1	116.2	
Blue Stores... 10.2	43.3	106.0	
Upper Red Hook 6.5	49.8	99.5	
Red Hook 2.5	52.3	97.0	
Rhinebeck 5.9	58.2	91.1	
Hyde Park 10.3	68.5	80.8	



Covered Bridge in West.

Poughkeepsie ... 6.0	74.5	74.8
Wappinger Falls 7.7	82.2	67.1
Hughsonville ... 1.4	83.6	65.7
Fishkill Landing 6.1	89.7	59.6
Cold Spring 7.0	96.7	52.6
Peekskill 12.0	108.7	40.6
Croton-on-Hudson .. 8.6	117.3	32.0
Ossining 2.7	120.0	29.3
Tarrytown 5.3	125.2	24.1
Yonkers 12.2	137.4	11.9
New York, N. Y. 11.9	149.3	0.0

ITINERARY. ST. LOUIS-CHICAGO.

Night Stops—St. Louis, Mo.;
Springfield, Bloomington and
Chicago, Ill. Three Days, 333.8
Miles.

St. Louis-Springfield, 107.8
Miles.

	Total Miles	Miles to	Out Return
St. Louis..... 0.0	0.0	107.8	
E. St. Louis..... 2.1	2.1	105.7	
Collinsville 10.8	12.9	94.9	
Troy 3.0	15.9	91.9	
Marysville 1.2	17.1	90.7	
Edwardsville ... 8.3	25.4	82.4	
Hamel 8.2	33.6	74.2	
Stanton 11.0	44.6	63.2	
Mt. Olive 6.4	51.0	56.8	
Litchfield 10.9	61.9	45.9	
Glenarm 31.6	93.5	14.3	
Cotton Hill..... 6.2	99.7	8.1	
Springfield 8.1	107.8	0.0	

Springfield-Bloomington, 76.5
Miles.

	Total Miles	Miles to	Out Return
Springfield 0.0	0.0	76.5	
Williamsville ... 15.0	15.0	61.5	
Elkhart 8.0	23.0	53.5	
Lincoln 14.5	37.5	39.0	
McLean 20.9	58.4	18.1	
Shirley 11.2	69.6	6.9	
Bloomington 6.9	76.5	0.0	

Bloomington-Chicago, 149.5
Miles.

	Total Miles	Miles to	Out Return
Bloomington 0.0	0.0	149.5	
Towanda 8.2	8.2	141.3	
Lexington 10.1	18.3	131.2	
Pontiac 22.9	41.2	108.3	
Odell 10.8	52.0	97.5	
Dwight 8.1	60.1	89.4	
Morris 19.3	79.4	70.1	
Minooka 13.3	92.7	56.8	
Joliet 13.9	106.6	42.9	
Lockport 4.0	110.6	38.9	
LaGrange 19.5	130.1	19.4	
Forest Park..... 9.5	139.6	9.9	
Chicago 9.9	149.5	0.0	

GREAT LAKES AND MISSISSIPPI VALLEY.

From Buffalo to Chicago and Return Around Lake Erie—Tours North and South in Middle West—The Center of Automobile Industry.

IN THE territory immediately south of the Great Lakes and in the Mississippi valley, there are no especially grand scenic effects, but the roads are excellent and connect hundreds of thriving cities and hamlets that are interesting to tourists. These trips include several of the middle western cities which, in industrial growth, are rapidly outstripping the older cities of the eastern states and are veritable hives of industry.

One of these tours, which passes through the centre of the automobile industry of the world, lays around the southern shores of Lake Erie and Lake Michigan to Chicago, returning via a northward route into Michigan and along the northern shore of Lake Erie back to Buffalo.

in the heart of the fruit growing district that borders the eastern shore of Lake Michigan.

St. Joseph is connected with Chicago by daily excursion steamers and is a Gretna Green for runaway lovers from the Illinois metropolis. West from St. Joseph the route strikes Battle Creek, which is famous for its sanatoriums and breakfast foods. It goes through Jackson, a manufacturing city, which is the seat of many motor car plants. Ann Arbor is chiefly famous as the location of the University of Michigan, the first of the great western state universities.

Detroit is the great centre of the automobile trade. It is an exceptionally beautiful town, laid out on the plan of Washington, with diagonal avenues. There are

of William McKinley and his body lies there under an impressive monument. It is also on the Lincoln highway. Zanesville, further south, is a point on the National Old Trails road transcontinental highway. Columbus is a thriving inland manufacturing city and is the capital of Ohio. Among the state institutions located there are the state university and the state prison.

Cincinnati is one of the oldest, and for a long time was the largest of Ohio cities. It owed its early greatness to the river traffic on the Ohio, and lost its pre-eminence when that traffic became in a measure replaced by railroad service.

ITINERARY.

BUFFALO-CHICAGO.

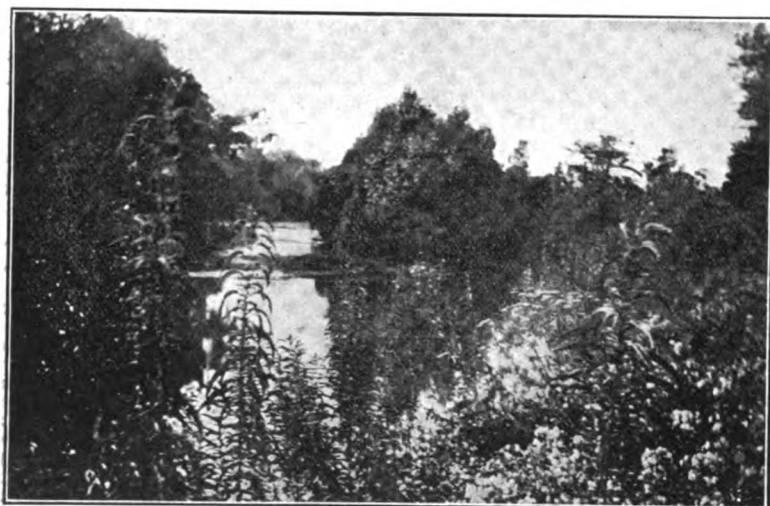
Night Stops—Buffalo, N. Y.; Ashtabula and Toledo, O.; South Bend, Ind.; Chicago, Ill.; St. Joseph, Battle Creek and Detroit, Mich.; London, Ont. Nine Days, 1189 Miles.

Buffalo-Ashtabula, 134.6 Miles.

	Total Miles		
	Miles to	Out	Return
Buffalo	0.0	0.0	134.6
Evans	21.2	21.2	113.4
Irving	7.6	28.8	105.8
Silver Creek	3.4	32.2	102.4
Sheridan	5.9	38.1	96.5
Fredonia	6.0	44.1	90.5
Brocton	6.8	50.9	83.7
Portland	1.4	52.3	82.3
Westfield	6.9	59.2	75.4
Forsythe	5.3	64.5	70.1
Ripley	3.8	68.3	66.3
State Line	3.0	71.3	63.3
Northeast, Penn.	4.4	75.7	58.9
Harbor Creek	7.2	82.9	51.7
Wesleyville	3.8	86.7	47.9
Erie	3.3	90.0	44.6
Fairview	12.4	102.4	32.2
Girard	3.8	106.2	28.4
East Springfield	5.5	111.7	22.9
West Springfield	3.8	115.5	19.1
Conneaut, O.	4.6	120.1	14.5
Amboy	3.4	123.5	11.1
Kingsville	4.6	128.1	6.5
Ashtabula	6.5	134.6	0.0

Ashtabula-Toledo, 178.3 Miles.

	Total Miles		
	Miles to	Out	Return
Ashtabula	0.0	0.0	178.3
Saybrook	5.6	5.6	172.7
Geneva	4.2	9.8	168.5
Unionville	4.3	14.1	164.2
Madison	2.5	16.6	161.7
Painesville	11.1	27.7	150.6
Mentor	5.8	33.5	144.8
Willoughby	4.9	38.4	139.9
Wickliffe	5.8	44.2	134.1
Euclid	2.8	47.0	131.3
Cleveland	10.3	57.3	121.0
Rocky River	8.0	65.3	113.0
Finney's Corners	1.8	67.1	111.2
Dover	4.4	71.5	106.8
Bement	3.4	74.9	103.4
Ridgeville	3.7	78.6	99.7



The St. Joe, Picturesque River in Indiana.

Outbound it runs along the south shore of Lake Erie, through the city of Erie, Penn., Geneva-on-the-Lake, a well known summer resort, Ashtabula, Conneaut, Cleveland, Sandusky and Toledo.

At Sandusky is Cedar Point, one of the largest and best patronized watering places in the middle west, and from the city also steamers operate over the short run to Put-in-Bay Island, where Perry destroyed the English fleet in the war of 1812, and which is the site of a large summer colony with many hotels.

From Toledo the route goes through Goshen, South Bend and Valparaiso to Chicago.

Returning it runs through Michigan City, where there are very high sand dunes on the shore of Lake Michigan, to St. Joseph,

many fine parks on which Belle Isle, an island in the Detroit river, is the best known.

The Detroit river is crossed and the tourist finds himself at Windsor, Ont. Thence the route leads eastward through Leamington, London, Hamilton and Niagara Falls to Buffalo.

This takes the tourist out of Cleveland toward the south. Cleveland is a city with a population of about three-quarters of a million, on the shore of Lake Erie.

Akron is the first important town out of Cleveland. It is well known as the centre of the automobile tire trade. Its population has grown enormously with the increasing demand for automobile tires. Nearly 30,000 people are employed in that industry alone.

Canton was known as the home

Elyria	4.7	83.3	95.0
Amherst	7.4	90.7	97.6
Henrietta	3.3	94.0	94.3
Birmingham	2.7	96.7	81.6
Berlinville	8.8	105.5	72.8
Norwalk	7.0	112.5	65.8
Monroeville	4.8	117.3	61.0
N. Monroeville	3.8	121.1	57.3
Bellevue	6.0	127.1	51.3
Clyde	7.6	134.7	43.6
Sandusky Jet	6.9	141.6	39.7
Freemont	0.7	143.3	39.0
Woodville	14.6	154.9	21.4
Lemoyne	6.5	163.4	14.9
Stony Bridge	2.0	165.4	13.9
Toledo	12.9	178.3	0.0

Toledo-South Bend, 166 Miles.

Miles to		Total Miles	
		Out	Return
Toledo	0.0	0.0	166.0
Java	17.0	17.0	149.0
Swanton	6.5	23.5	142.5
Delta	6.8	30.3	135.7
Wauseon	8.6	38.9	127.1
Archbold	10.3	49.2	116.8
Stryker	7.1	56.3	109.7
Bryan	8.1	64.4	101.6
Edgerton	11.6	76.0	90.0
Butler, Ind.	7.0	83.0	83.0
Waterloo	7.7	90.7	75.3
Kendallville	13.5	104.2	61.8
Brimfield	7.0	111.2	54.8
Wawaka	4.5	115.7	50.3
Ligonier	6.2	121.9	44.1
Millersburg	9.2	131.1	34.9
Goshen	9.4	140.5	25.5
Elkhart	10.3	150.7	15.3
Osceola	6.0	156.7	9.3
Mishawaka	5.3	162.0	4.0
South Bend	4.0	166.0	0.0

South Bend-Chicago, 101.1 Miles.

Miles to		Total Miles	
		Out	Return
South Bend	0.0	0.0	101.1
New Carlisle	13.6	13.6	87.5
La Porte	12.3	25.9	75.2
Pinhook	8.4	34.3	66.8
Westville	2.7	37.0	64.1
Valparaiso	10.3	47.3	53.8
Wheeler	7.5	54.8	46.3
Hobart	5.3	60.0	41.1
Gary	4.0	64.0	37.1
Highlands	7.4	71.4	29.7
Heaville	2.2	73.6	27.5
Gibson	1.1	74.7	26.4
Grassfield	1.0	75.7	25.4
Calumet	0.9	76.6	24.5
East Chicago	1.1	77.7	23.4
Whiting	3.0	80.7	20.4
South Chicago	5.3	86.0	15.1
Bryn M. wr.	3.0	89.0	12.1
Chicago	12.1	101.1	0.0

Chicago-St. Joseph, 122.8 Miles.

Miles to		Total Miles	
		Out	Return
Chicago	0.0	0.0	122.8
Washington Park	6.2	6.2	116.6
Burnside	5.3	11.4	111.4
Roseland	3.1	14.5	108.3
Kensington	0.7	15.2	107.6
Riverdale	2.6	17.8	105.0
Dolton	0.7	18.5	104.3
Oak Glen	6.3	24.8	98.0
Lansing	1.4	26.2	96.6
Munster	0.7	26.9	95.9
Highlands, Ind.	3.1	30.0	92.8
Gary	7.4	37.4	85.4
Hobart	4.0	41.4	81.4
Porter	13.1	54.5	68.3
Michigan City	16.2	70.7	52.1
Rolling Prairie	14.8	85.5	37.3
Hudson Lake	5.0	90.5	32.3
Gallen, Mich.	7.8	98.3	24.5
Glendora	5.9	104.2	18.6
Hill's Corners	6.0	110.2	12.6
Baroda	1.0	111.2	11.6
Stevensville	4.4	115.6	7.2
St. Joseph	7.2	122.8	0.0

St. Joseph-Battle Creek, 75 Miles.

Miles to		Total Miles	
		Out	Return
St. Joseph	0.0	0.0	75.0
Benton Harbor	1.4	1.4	73.6
Riverside	6.1	7.5	67.5
Coloma	4.2	11.7	63.3

Watervliet	2.3	14.0	61.0
Hartford	4.8	18.8	56.2
Lawrence	5.8	24.6	50.4
Paw Paw	8.8	33.4	41.6
Almena	5.6	39.0	36.0
Kalamazoo	12.6	51.6	23.4
Galesburg	8.6	60.2	14.8
Gull Lake Junction	5.3	65.5	9.5
Battle Creek	9.5	75.0	0.0

Battle Creek-Detroit, 116.5 Miles.

Miles to		Total Miles	
		Out	Return
Battle Creek	0.0	0.0	116.5
Cresco	8.0	8.0	108.5
Marshall	5.1	13.1	103.4
Albion	11.3	24.4	92.1
Farma	7.9	32.3	84.3
Jackson	10.3	42.6	73.9
Grass Lake	10.1	52.7	63.8
Chelsea	11.3	64.0	52.5
Lima Center	8.6	72.6	43.9
Ann Arbor	10.1	82.7	33.8
Ypsilanti	8.4	91.1	25.4
Wayne	12.2	103.3	13.2
Dearborn	7.2	110.5	6.0
Detroit	6.0	116.5	0.0

Detroit-London, 142 Miles.

Miles to		Total Miles	
		Out	Return
Detroit	0.0	0.0	142.0
Windsor, Ont.	0.4	0.4	141.6
Old Castle	8.9	9.3	132.7
Maldstone	3.5	12.8	129.2

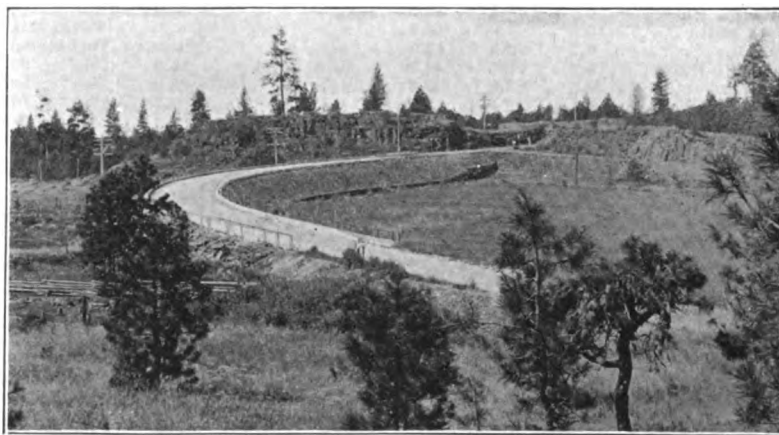
Jordan	1.8	107.9	44.8
St. Catharines	7.1	115.0	37.7
Homer	3.3	118.3	34.4
St. Davids	4.9	123.2	29.5
Stamford	2.1	125.3	27.4
Niagara Falls, Ont.	4.8	130.1	22.6
N. Y.	1.0	131.1	21.6
Echota Station	2.5	133.6	19.1
La Salle	3.0	136.6	16.1
Gratwick	4.5	141.1	11.6
N. Tonawanda	1.7	142.8	9.9
Tonawanda	0.4	143.2	9.5
Buffalo	9.5	152.7	0.0

ITINERARY.**VANCOUVER-SAN FRANCISCO.**

Night Stops—Vancouver, B. C.; Seattle and Chehalis, Wash.; Portland, Salem, Cottage Grove, Riddle and Medford, Ore.; Sisson, Redding, Chico and Sacramento, Cal. Eleven Days, 1076.2 Miles.

Vancouver-Seattle, 138 Miles.

Miles to		Total Miles	
		Out	Return
Vancouver	0.0	0.0	138.0
New Westminster	8.0	8.0	130.0
Brownsville	3.0	11.0	127.0
Blaine, Wash.	15.0	26.0	112.0

**A Winding Road Through State of Washington.**

Essex	4.5	17.3	124.7
Ollinda	5.3	22.6	119.4
Ruthven	7.8	30.4	111.6
Leamington	3.6	34.0	108.0
Wheatley	7.8	41.8	100.2
Cedar Springs	20.7	68.5	73.5
Blenheim	4.1	72.6	69.4
Ridgetown	9.9	82.5	59.5
Highgate	6.4	88.9	53.1
Clachan	7.7	96.6	45.4
Wardville	7.5	104.1	37.9
Wood Green	3.1	107.2	34.8
Strathburn	3.0	110.2	31.8
Melbourne	9.3	119.5	22.5
Delaware	9.4	128.9	13.1
Lambeth	6.6	135.5	6.5
London	6.5	142.0	0.0

London-Buffalo, 152.7 Miles.

Miles to		Total Miles	
		Out	Return
London	0.0	0.0	152.7
Crumlin	5.8	5.8	146.9
Thamesford	8.3	14.1	138.6
Ingersoll	6.3	20.4	132.3
Beachville	4.7	25.1	127.6
Woodstock	4.7	29.8	122.9
Oxford	4.5	34.3	118.4
Cathcart	8.1	42.4	110.3
Brantford	13.9	56.3	96.4
Gainsville	3.3	59.6	93.1
Ancaster	13.2	72.8	79.9
Hamilton	6.8	79.6	73.1
Stony Creek	6.7	86.3	66.4
Winona	5.6	91.9	60.8
Grimaby	5.1	97.0	55.7
Beamsville	4.9	101.9	50.8
Vineland	4.2	106.1	46.6

Custer	8.0	34.0	104.0
Barndale	5.0	39.0	99.0
Bellingham	10.0	49.0	89.0
Bow	13.0	62.0	76.0
Mt. Vernon	10.0	72.0	66.0
Conway	6.0	78.0	60.0
English	20.0	98.0	40.0
Shohomish	15.0	113.0	25.0
Kenmore	15.0	128.0	10.0
Seattle	10.0	138.0	0.0

Seattle-Chehalis, 131 Miles.

Miles to		Total Miles	
		Out	Return
Seattle	0.0	0.0	131.0
Christopher	32.0	32.0	99.0
Tacoma	8.0	40.0	91.0
South Tacoma	11.0	51.0	80.0
Rainier	24.0	75.0	56.0
Olympia	21.0	96.0	35.0
Tenino	15.0	111.0	20.0
Centralia	16.0	127.0	4.0
Chehalis	4.0	131.0	0.0

Chehalis-Portland, 100.5 Miles.

Miles to		Total Miles	
		Out	Return
Chehalis	0.0	0.0	100.5
Cowlitz	18.2	18.2	82.3
Toledo	1.9	20.1	80.4
Castle Rock	16.0	36.1	64.4
Lexington	8.9	45.0	55.5
Kelso	1.5	46.5	54.0
Carrollton	7.0	53.5	47.0
Kalama	5.5	59.0	41.5
Woodlawn Ferry	10.1	69.1	31.4
La Centre	5.6	74.7	25.8
Vancouver	18.4	93.1	7.4
Portland, Ore.	7.4	100.5	0.0

Portland-Salem, 94 Miles.

	Miles to	Total Miles	Out Return
Portland	0.0	0.0	94.0
Oregon City	19.0	19.0	75.0
Salem	75.0	94.0	0.0

Salem-Cottage Grove, 99 Miles.

	Miles to	Total Miles	Out Return
Salem	0.0	0.0	99.0
Jefferson	18.8	18.8	59.2
Albany	9.3	28.0	71.0
Hamburg	30.8	58.8	40.2
Junction City	4.7	63.5	35.5
Eugene	12.5	77.0	22.0
Gresham	6.9	83.9	15.1
Cottage Grove	15.1	99.0	0.0

Cottage Grove-Riddle, 80.2 Miles.

	Miles to	Total Miles	Out Return
Cottage Grove	0.0	0.0	80.2
Krownson	15.3	15.3	65.0
Yoncalles	18.8	34.0	46.2
Oakland	3.8	37.8	42.4
Southern	3.4	41.2	39.0
Roseburg	12.9	55.1	25.1
Dole	13.0	68.1	12.1
Myrtle Creek	5.1	73.2	7.0
Riddle	7.0	80.2	0.0

Riddle-Medford, 84 Miles.

	Miles to	Total Miles	Out Return
Riddle	0.0	0.0	84.0
Wolf Creek	28.3	28.3	55.7
Grant's Pass	20.2	48.5	35.5
Gold Hill	19.3	67.8	16.2
Tolo	4.7	72.5	11.5
Central Point	5.2	77.7	6.8
Medford	6.3	84.0	0.0

Medford-Sisson, 75.1 Miles.

	Miles to	Total Miles	Out Return
Medford	0.0	0.0	75.1
Ashland	2.8	2.8	72.3
Rawhide Toll			
Gate, Cal.	1.8	4.6	70.5
Siskiyou Pass ..	2.0	6.6	68.5
Coles	6.0	12.6	62.5
Hornbrook	11.9	24.5	50.6
Montague	15.1	39.6	35.5
Edgewood	21.5	61.1	14.0
Weed	4.1	65.2	9.9
Sisson	9.9	75.1	0.0

Sisson-Redding, 83.9 Miles.

	Miles to	Total Miles	Out Return
Sisson	0.0	0.0	83.9
Shasta Springs ..	8.6	8.6	75.3
Dunsmuir	3.3	11.9	72.0
Castle Brook	6.0	17.9	66.0
Castella	1.3	19.2	64.7
Southern	6.7	25.9	58.0
Kennett	43.0	68.9	15.0
Buckeye	10.1	79.0	4.9
Redding	4.9	83.9	0.0

Redding-Chico, 76.5 Miles.

	Miles to	Total Miles	Out Return
Redding	0.0	0.0	76.5
Anderson	11.8	11.8	64.7
Cottonwood	5.7	17.5	59.0
Red Bluff	16.4	33.9	42.6
Proberta	7.4	41.3	35.2
Vina	15.1	56.4	20.1
Chico	20.1	76.5	0.0

Chico-Sacramento, 114 Miles.

	Miles to	Total Miles	Out Return
Chico	0.0	0.0	114.0
Live Oaks	37.7	37.7	76.3
Marysville	12.8	50.5	63.5
Wheatland	16.9	67.4	46.6
Sheridan	4.4	71.8	42.2
Lincoln	10.6	82.4	31.6
Roseville	10.2	92.6	21.4
Ben Ali	16.2	108.8	5.2
Sacramento	5.2	114.0	0.0

ITINERARY.

WINNIPEG-GALVESTON.

Night Stops—Winnipeg, Man.;
Pembina, Grand Forks and Far-
go, N. D.; Ortonville, Minn.;
Brookings, S. D.; Sioux City, Ia.

Omaha, Neb.; Hiawatha, Topeka,
Emporia and Wichita, Kan.;
Enid, Oklahoma City and Law-
ton, Okla.; Wichita Falls, Fort
Worth, Waco, Bryan, Houston
and Galveston, Tex. Twenty-
Days, 2023.9 Miles.

Winnipeg-Pembina, 73 Miles.

	Miles to	Total Miles	Out Return
Winnipeg	0.0	0.0	73.0
St. Norbert	9.9	9.9	63.1
St. Nararde	13.6	23.5	49.5
Morris	18.0	41.5	31.5
St. Jean Baptiste ..	6.2	47.7	25.3
Letellier	8.8	56.5	16.5
Emerson	12.5	69.0	4.0
Pembina, N. D.	4.0	73.0	0.0

Pembina-Grand Forks, 85.5 Miles.

	Miles to	Total Miles	Out Return
Pembina	0.0	0.0	85.5
Hamilton	17.6	17.6	67.9
Glasston	6.9	24.5	61.0
St. Thomas	6.3	30.8	54.7
Auburn	7.0	37.8	47.7
Grafton	6.8	44.6	40.9
Minto	10.4	55.0	30.5
Ardoce	6.7	61.7	23.8
Manvel	12.3	74.0	11.5
Grand Forks	11.5	85.5	0.0

Grand Forks-Fargo, 95.5 Miles.

	Miles to	Total Miles	Out Return
Grand Forks	0.0	0.0	95.5
Merrifield	8.9	8.9	86.6
Thompson	4.7	13.6	81.9
Reynolds	7.2	20.8	74.7
Buxton	5.5	26.3	69.2
Taft	11.4	37.7	57.8
Hillsboro	3.5	41.2	54.3
Mapleton	40.8	82.0	13.5
Fargo	13.5	95.5	0.0

Fargo-Ortonville, 124 Miles.

	Miles to	Total Miles	Out Return
Fargo	0.0	0.0	124.0
Saunders	4.5	4.5	119.5
Wild Rice	4.0	8.5	115.5
Hickson	7.2	15.7	108.3
Christine	5.8	21.5	102.5
Abercrombie	11.5	33.0	91.0
Dwight	10.0	43.0	81.0
Wahpeton	8.5	51.5	72.5
Tyler	8.0	59.5	64.5
Fairmont	6.5	66.0	58.0
Blackmer	6.2	72.2	51.8
White Rock, Minn.	4.5	76.7	47.3
Wheaton	10.5	87.2	36.8
Dumont	7.3	94.5	29.5
Collis	3.5	98.0	26.0
Graceville	6.5	104.5	19.5
Clinton	7.0	111.5	12.5
Ortonville	12.5	124.0	0.0

Ortonville-Brookings, 89 Miles.

	Miles to	Total Miles	Out Return
Ortonville	0.0	0.0	89.0
Big Stone City, S. D.	1.0	1.0	88.0
Mill Bank	13.5	14.5	74.5
La Bolt	13.5	28.0	61.0
Altamont	14.5	42.5	46.5
Clear Lake	7.0	49.5	39.5
Toronto	14.0	63.5	25.5
Brookings	25.5	89.0	0.0

Brookings-Sioux City, 145.3 Miles.

	Miles to	Total Miles	Out Return
Brookings	0.0	0.0	145.3
Dell Rapids	33.0	33.0	107.3
Sioux Falls	20.0	53.0	87.3
Worthing	16.5	69.5	70.8
Beresford	17.5	87.0	53.3
Elk Point	32.8	119.8	20.5
Jefferson	15.5	135.3	5.0
Sioux City, Ia.	5.0	140.3	0.0

Sioux City-Omaha, 109.1 Miles.

	Miles to	Total Miles	Out Return
Sioux City	0.0	0.0	109.1
Salix	16.5	16.5	92.6

Sloan	7.5	24.6	85.1
Whitney	10.7	34.7	74.4
Omaha	8.0	42.7	36.4
River Sioux	16.3	59.0	50.1
Missouri Valley	22.5	81.5	27.6
Loveland	4.5	86.0	23.1
Honey Creek	4.5	90.5	18.6
Crescent	6.2	96.7	12.4
Council Bluffs	8.0	104.7	4.4
Omaha, Neb.	4.4	109.1	0.0

Omaha-Hiawatha, 123 Miles.

	Miles to	Total Miles	Out Return
Omaha	0.0	0.0	123.0
South Omaha	4.3	4.3	118.8
Albright	3.0	7.3	115.8
Fort Crook	3.0	10.3	112.8
La Platte	4.0	14.3	108.8
Plattsmouth	6.2	20.4	102.6
Mynard	3.5	23.9	99.1
Murray	4.0	27.9	95.1
Wyoming	13.0	40.9	82.1
Nebraska City	7.2	48.1	74.9
Julian	10.5	58.6	64.4
Auburn	10.0	68.6	54.4
Howe	6.2	74.8	48.2
Stella	8.5	83.3	39.7
Verdon	9.5	92.8	30.2
Falls City	11.5	104.3	18.7
Hiawatha, Kan.	18.7	123.0	0.0

Hiawatha-Topeka, 70.5 Miles.

	Miles to	Total Miles	Out Return
Hiawatha	0.0	0.0	70.5
Horton	14.0	14.0	56.5
Whiting	9.5	23.5	47.0
Holton	15.0	38.5	32.0
Mayetta	9.3	47.8	22.7
Hoyt	7.0	54.8	15.7
Topeka	15.7	70.5	0.0

Topeka-Emporia, 75.5 Miles.

	Miles to	Total Miles	Out Return
Topeka	0.0	0.0	75.5
Wakarusa	12.5	12.5	63.0
Scranton	10.5	23.0	52.5
Burlingame	6.8	29.8	45.7
Osage City	10.2	40.0	35.5
Lebo	15.5	55.5	20.0
Emporia	20.0	75.5	0.0

Emporia-Wichita, 108.5 Miles.

	Miles to	Total Miles	Out Return
Emporia	0.0	0.0	108.5
Plymouth	8.5	8.5	100.0
Saffordville	2.5	11.0	97.5
Ellinor	2.0	13.0	94.5
Cottonwood Falls ..	7.8	21.8	86.7
Elmdale	6.2	28.0	80.5
Clements	7.7	35.7	72.8
Cedar Point	6.5	42.2	66.3
Florence	6.7	48.9	59.6
Peabody	14.8	63.7	44.8
Walton	11.6	75.3	33.2
Newton	8.2	83.5	25.0
Wichita	25.0	108.5	0.0

Wichita-Enid, 117 Miles.

	Miles to	Total Miles	Out Return
Wichita	0.0	0.0	117.0
Wellington	31.3	31.3	85.8
South Haven	15.0	46.3	70.8
Druey	5.3	51.5	65.5
Caldwell	6.5	58.0	59.0
Renfrow, Okla.	10.0	68.0	49.0
Medford	12.5	80.5	36.5
Pond Creek	12.5	93.0	24.0
Kremala	10.0	103.0	14.0
Enid	14.0	117.0	0.0

Enid-Oklahoma City, 96.5 Miles.

	Miles to	Total Miles	Out Return
Enid	0.0	0.0	96.5
Waukomis	8.0	8.0	88.5
Bison	6.5	14.5	82.0
Hennessey	7.0	21.5	75.0
Dover	11.0	32.5	64.0
Kingfisher	11.8	44.3	52.2
El Reno	25.2	69.5	27.0
Oklahoma City	27.0	96.5	0.0

Oklahoma City-Lawton, 141.5 Miles.

	Miles to	Total Miles	Out Return
Oklahoma City	0.0	0.0	141.5
El Reno	27.0	27.0	114.5
Pocasset	37.0	64.0	77.5

Chickasha	11.0	75.0	66.5
Anadarko	21.0	96.0	45.5
Apache	18.7	114.7	26.8
Rohrer	13.0	127.7	13.8
Lawton	13.8	141.5	0.0

Lawton-Wichita Falls, 60.5 Miles.

	Miles to	Out	Total Miles
		Return	
Lawton	0.0	0.0	60.5
Geronimo	10.0	10.0	50.5
Emerson	9.0	19.0	41.5
Handlett	15.0	34.0	26.5
Burkhardt, Tex.	11.5	45.5	15.0
Wichita Falls	15.0	60.5	0.0

Wichita Falls-Fort Worth, 125.5 Miles.

	Miles to	Out	Total Miles
		Return	
Wichita Falls	0.0	0.0	125.5
Henrietta	25.0	25.0	100.5
Bellevue	15.5	40.5	85.0
Bowie	16.0	56.5	69.0
Fruitland	8.0	64.5	61.0
Sunset	11.0	75.5	50.0
Decatur	12.0	87.5	38.0
Rhome	10.5	98.0	27.5
Saginaw	16.0	114.0	11.5
Fort Worth	11.5	125.5	0.0

Fort Worth-Waco, 135 Miles.

	Miles to	Out	Total Miles
		Return	
Fort Worth	0.0	0.0	135.0
Crowley	20.0	20.0	115.0
Cleburne	18.0	38.0	97.0
George's Creek	14.0	52.0	83.0
Nemo	5.5	57.5	77.5
Rainbow	4.5	62.0	73.0
Glenrose	4.0	66.0	69.0
Walnut Springs	12.0	78.0	57.0
Meridian	9.0	87.0	48.0
Clifton	13.0	100.0	35.0
Valley Mills	10.0	110.0	25.0
China Springs	12.0	122.0	13.0
Waco	13.0	135.0	0.0

Waco-Bryan, 85.5 Miles.

	Miles to	Out	Total Miles
		Return	
Waco	0.0	0.0	85.5
Battle	12.0	12.0	73.5
Reese	5.5	17.5	68.0
Perry	5.5	23.0	62.5
Marlin	8.0	31.0	54.5
Regan	7.0	38.0	47.5
Bremont	9.0	47.0	38.5
Calvert	12.0	59.0	26.5
Carne	8.0	67.0	18.5
Sutton	5.0	72.0	13.5
Bentley	6.0	78.0	7.5
Bryan	7.5	85.5	0.0

Bryan-Houston, 105.5 Miles.

	Miles to	Out	Total Miles
		Return	
Bryan	0.0	0.0	105.5
Myers	7.5	7.5	98.0
Wellborn	7.0	14.5	91.0
Millican	6.0	20.5	85.0
Nevasota	10.0	30.5	75.0
Courtney	8.0	38.5	67.0
Howth	5.0	43.5	62.0
Hemstead	4.5	48.0	57.5
Prarie View	5.5	53.5	52.0
Waller	6.0	59.5	46.0
Hockley	10.0	69.5	36.0
Cypress	11.5	81.0	24.5
Latsuma	7.5	88.5	17.0
Fairbanks	5.0	93.5	12.0
Houston	12.0	105.5	0.0

Houston-Galveston, 58.5 Miles.

	Miles to	Out	Total Miles
		Return	
Houston	0.0	0.0	58.5
South Houston	8.5	8.5	50.0
Seabrook	6.0	14.5	44.0
League City	11.0	25.5	33.0
Dickinson	8.5	34.0	24.5
Texas City	9.5	43.5	15.0
Galveston	15.0	58.5	0.0

ITINERARY. DENVER-PHOENIX.

Night Stops—Denver, Colorado Springs, Pueblo and Trinidad, Col.; Las Vegas, Santa Fe, Albuquerque and McCarty, N. M.; Springerville, Globe and Phoenix, Ariz. Ten Days, 942 Miles.

Denver-Colorado Springs, 69.2 Miles.

	Miles to	Out	Total Miles
		Return	
Denver	0.0	0.0	69.2
Littleton	9.0	9.0	60.2
Aspen	7.0	16.0	53.2
Gunn	3.5	19.5	49.7
Sedalia	3.8	23.3	45.9
Perry Park	14.0	37.3	31.9
Palmer Lake	9.2	46.5	22.7
Monument Lake	3.0	49.5	19.7
Pring	3.5	53.0	16.2
Custard	2.5	55.5	13.7
Breed	5.7	61.2	8.0
Pike View	3.5	64.7	4.5
Colorado Springs	4.5	69.2	0.0

Colorado Springs-Pueblo, 42.5 Miles.

	Miles to	Out	Total Miles
		Return	
Colorado Springs	0.0	0.0	42.5
Kelker	4.5	4.5	38.0
Fountain	8.5	13.0	29.5
Buttes	7.3	20.3	22.3
Pinlon	10.5	30.8	11.7
Bragdon	3.5	34.3	8.2
Eden	2.0	36.3	6.2
Pueblo	6.2	42.5	0.0

Pueblo-Trinidad, 90 Miles.

	Miles to	Out	Total Miles
		Return	
Pueblo	0.0	0.0	90.0
Walsenburg	50.5	50.5	39.5
Pryor	10.0	60.5	29.5
Acular	9.3	69.8	20.2
Chicoa	10.2	80.0	10.0
Bowen	4.5	84.5	5.5
Trinidad	5.5	90.0	0.0

Trinidad-Las Vegas, 141 Miles.

	Miles to	Out	Total Miles
		Return	
Trinidad	0.0	0.0	141.0
Starkville	4.0	4.0	137.0
Gallinas	5.0	9.0	132.0
Morley	2.3	11.3	129.7
Raton, N. M.	14.0	25.3	115.7
Dorsey	17.2	42.5	98.5
Maxwell	11.5	54.0	87.0
French	5.0	59.0	82.0
Springer	10.7	69.7	71.3
Rayado	5.8	75.5	65.5
Colmor	4.8	80.3	60.7
Nolan	4.0	84.3	56.7
Wagon Mound	13.3	97.6	43.4
Watrous	23.0	120.6	20.4
Onara	9.7	130.3	10.7
Arriba	8.5	138.8	2.2
Las Vegas	2.3	141.0	0.0

Las Vegas-Santa Fe, 75.3 Miles.

	Miles to	Out	Total Miles
		Return	
Las Vegas	0.0	0.0	75.3
Tecolote	12.0	12.0	63.3
Bernal	6.3	18.3	57.0
Fulton	15.3	33.6	41.7
Pajarita	7.0	40.6	34.7
Rowe	2.3	42.9	32.4
Pecos	6.7	49.6	25.7
Glorieta	6.0	55.6	19.7
Canoncito	4.5	60.1	15.2
Santa Fe	15.2	75.3	0.0

Santa Fe-Albuquerque, 66.7 Miles.

	Miles to	Out	Total Miles
		Return	
Santa Fe	0.0	0.0	66.7
Agua Fria	5.0	5.0	61.7
La Bajada	16.2	21.3	45.5
Domingo	5.7	26.9	39.8
Algodones	14.3	41.3	25.5
Old Bernalillo	5.3	46.5	20.2
Bernalillo	2.3	48.8	17.9
Sandia	3.7	52.5	14.2
Alameda	6.2	58.7	8.6
Albuquerque	8.0	66.7	0.0

Albuquerque-McCarty, 82.3 Miles.

	Miles to	Out	Total Miles
		Return	
Albuquerque	0.0	0.0	82.3
Atrisco	3.3	3.3	79.0
Laguna	45.0	48.3	34.0
Casa Blanca	6.7	55.0	27.3
Enchanted Mesa	10.7	65.7	16.6
McCarty	16.6	82.3	0.0

McCarty-Springerville, 112 Miles.

	Miles to	Out	Total Miles
		Return	
McCarty	0.0	0.0	112.0
Nation's Ranch	75.5	75.5	36.5
Laguna Salina	12.5	88.0	24.0
Springerville, Ariz.	24.0	112.0	0.0

Springerville-Globe, 148 Miles.

	Miles to	Out	Total Miles
		Return	
Springerville	0.0	0.0	148.0
Cooley's Ranch	42.0	42.0	106.0
White Mountain Reservation	19.0	61.0	87.0
Forage	42.0	103.0	45.0
Rice	22.5	125.5	22.5
Globe	22.5	148.0	0.0

Globe-Phoenix, 115 Miles.

	Miles to	Out	Total Miles
		Return	
Globe	0.0	0.0	115.0
Livingston	23.5	23.5	91.5
Roosevelt	11.3	34.8	80.2
Goldfield	43.2	78.0	37.0
Mesa	21.0	99.0	16.0
Frankenburg	5.3	104.3	10.7
Tempe	1.2	105.5	9.5
Phoenix	9.5	115.0	0.0

ITINERARY.

WINSTON-SALEM-SAVANNAH.

Night Stops—Winston-Salem, Raleigh, N. C.; Cheraw and Columbia, S. C.; Waynesboro, Savannah, Ga.; Five Days, 588.4 Miles.

Winston-Salem-Raleigh, 123.4 Miles.

	Miles to	Out	Total Miles
		Return	
Winston-Salem	0.0	0.0	123.4
Centerville	2.3	2.3	121.1
Kernersville	9.8	12.1	111.3
Oak Ridge	6.1	18.2	105.2
Summerfield	5.6	23.8	99.6
Gulford Court-house	6.7	30.5	92.9
Greensboro	5.8	36.3	87.1
Gibsonville	16.4	52.7	70.7
Elmira Hill	5.6	58.3	65.1

Burlington	1.0	59.3	64.1
Graham	2.9	62.3	61.3
Saxaphaw	12.2	74.4	49.0
Chapel Hill	18.4	92.8	30.6
Durham	12.1	104.9	18.5
Morrisville	14.1	119.0	4.4
Raleigh	4.4	123.4	0.0

Raleigh-Cheraw, 138.5 Miles.

		Total Miles	
Miles to		Out	Return
Raleigh	0.0	0.0	138.5
Method	4.2	4.2	134.3
Cary	4.0	8.2	130.3
Apex	6.7	14.9	123.6
New Hill	6.3	21.2	117.3
Haywood	9.4	30.6	107.9
Moncure	1.0	31.6	100.9
Lockville	0.6	32.2	106.3
Sanford	13.7	45.9	92.6
Jonesboro	2.3	48.2	90.3
Lemon Springs	6.3	54.5	84.0
Cameron	6.2	60.7	77.8
Vass	6.1	66.8	71.7
Lakeview	2.1	68.9	69.6
Manley Station	5.1	74.0	64.5
Southern Pines	1.4	75.4	63.1
Placemat	5.8	81.2	57.3
Jackson Springs	11.5	92.7	45.8
Ellerbe Springs	12.3	105.0	33.5
Rockingham	11.5	116.5	22.0
Dockery's Mill	6.0	122.5	16.0
Crossland's Mill	5.7	128.2	10.3
Kollock Station	7.5	135.7	2.8
Cheraw, S. C.	2.8	138.5	0.0

Cheraw-Columbia, 117.5 Miles.

		Total Miles	
Miles to		Out	Return
Cheraw	0.0	0.0	117.5
Cash Station	6.0	6.0	111.5
Society Hill	8.0	14.0	103.5
Darlington	15.0	29.0	88.5
Hartsville	14.0	43.0	74.5
Lydia	6.7	49.7	67.8
Una	2.3	52.0	65.5
Alcot	3.0	55.0	62.5
Bishopville	4.7	59.7	57.8
Manville	5.8	65.5	52.0
McCutcheon	0.5	66.0	51.5
Camden	19.0	85.0	32.5
Lugoff Station	4.3	89.3	28.2
Blaney	8.9	98.2	19.3
Jacobs	4.3	102.5	15.0
Columbia	15.0	117.5	0.0

Columbia-Waynesboro, 106.6 Miles.

		Total Miles	
Miles to		Out	Return
Columbia	0.0	0.0	106.6
Brookland	1.5	1.5	105.1
Lexington	10.9	12.4	94.2
Leesville	16.9	29.3	77.3
Batesburg	2.1	31.4	75.2
Alken	27.1	58.5	48.1
Warrenville	6.2	64.7	41.9
Langley	3.1	67.8	38.8
Clearwater	3.3	71.1	35.5
Augusta	5.0	76.1	30.5
McBean	18.3	94.4	12.2
Waynesboro	12.2	106.6	0.0

Waynesboro-Savannah, 102.3 Miles.

		Total Miles	
Miles to		Out	Return
Waynesboro	0.0	0.0	102.3
Perkin	13.9	13.9	88.4
Millen	8.0	21.9	80.4
Scarboro	7.7	29.6	72.7
Rocky Ford	4.8	34.4	67.9
Statesboro	16.9	51.3	51.0
Blitchee	28.8	80.1	22.2
Savannah	22.2	102.3	0.0

**ITINERARY.
SALT LAKE CITY-SEATTLE.**

Night Stops—Salt Lake City, Utah;
Malad City, Pocatello, Hailey,
Boise and Weiser, Idaho; La
Grande, Ore.; Walla Walla, North
Yakima, Cle Elum and Seattle,
Wash. Ten Days, 1001 Miles.

**Salt Lake City-Malad City,
111.5 Miles.**

		Total Miles	
Miles to		Out	Return
Salt Lake City	0.0	0.0	111.5
Bountiful	9.1	9.1	102.4
Centerville	2.2	11.3	100.2
Farmington	7.7	19.0	92.5
Kaysville	2.1	21.1	90.4
Layton	2.5	23.6	87.9
Clearfield	4.7	28.3	83.2
Ogden	9.1	37.4	74.1
North Ogden	5.9	43.3	68.2
Willard	5.0	51.3	60.2
Bingham	9.4	60.7	50.8
Honeyville	9.3	70.0	41.5
Deweyville	4.3	74.3	37.2
Collinston	4.7	79.0	32.5
Fielding	4.0	83.0	28.5
Plymouth	6.0	89.0	22.5
Portage	7.5	96.5	15.0
Cherry Creek, Idaho	8.7	105.2	6.3
Malad City	6.3	111.5	0.0

Malad City-Pocatello, 62.5 Miles.

		Total Miles	
Miles to		Out	Return
Malad City	0.0	0.0	62.5
Arimo	29.0	29.0	33.5
McCammon	6.5	35.5	27.0
Onyx	7.0	42.5	20.0
Nikun	5.5	48.0	14.5
Port Neuf	5.5	53.5	9.0
Pocatello	9.0	62.5	0.0

Pocatello-Hailey, 140 Miles.

		Total Miles	
Miles to		Out	Return
Pocatello	0.0	0.0	140.0
Rosa Fork	12.0	12.0	128.0
Gibson	6.0	18.0	122.0
Blackfoot	7.0	25.0	115.0
Taber	20.0	45.0	95.0
Cerro Grande	15.0	60.0	80.0
Powell	10.0	70.0	70.0
Arco	15.0	85.0	55.0
Martin	17.0	102.0	38.0
Muldoon	18.0	120.0	20.0
Hailey	20.0	140.0	0.0

Hailey-Boise, 112 Miles.

		Total Miles	
Miles to		Out	Return
Hailey	0.0	0.0	112.0
Blaine	16.0	16.0	96.0
Selby	7.0	23.0	89.0
Soldier	4.5	27.5	84.5
Corral	7.5	35.0	77.0
Little Camas	25.0	60.0	52.0
Thurman	24.0	84.0	28.0
Mayfield	10.0	94.0	18.0
Barber	12.0	106.0	6.0
Boise	6.0	112.0	0.0

Boise-Weiser, 83 Miles.

		Total Miles	
Miles to		Out	Return
Boise	0.0	0.0	83.0
Beatty	6.0	6.0	77.0

Sonna	8.0	14.0	69.0
Caldwell	12.0	26.0	57.0
Loraine	6.0	32.0	51.0
Jenness	5.0	37.0	46.0
Hanna	9.0	46.0	37.0
New Plymouth	12.0	58.0	25.0
Payette	9.0	67.0	16.0
Rebecca	11.0	78.0	5.0
Weiser	5.0	83.0	0.0

Weiser-La Grande, 106 Miles.

		Total Miles	
Miles to		Out	Return
Weiser	0.0	0.0	106.0
Feton	7.0	7.0	99.0
Blakes	8.0	15.0	91.0
Huntington, Ore.	3.0	18.0	88.0
Lime	4.0	22.0	84.0
Weatherby	6.0	28.0	78.0
Durkee	7.0	35.0	71.0
Pleasant Valley	12.0	47.0	59.0
Norton	8.0	55.0	51.0
Baker City	5.0	60.0	46.0
Haines	12.0	72.0	34.0
Hutchinson	5.0	77.0	29.0
North Powder	5.0	82.0	24.0
Tolocaset	6.0	88.0	18.0
Union	7.0	95.0	11.0
La Grande	11.0	106.0	0.0

La Grande-Walla Walla, 68 Miles.

		Total Miles	
Miles to		Out	Return
La Grande	0.0	0.0	68.0
Alice	6.0	6.0	62.0
Elgin	13.0	19.0	49.0
Berkley	23.0	42.0	26.0
Blue Mountain	10.0	52.0	16.0
Milton	5.0	57.0	11.0
Spofford	3.0	60.0	8.0
State Line	3.0	63.0	5.0
Walla Walla, Wash.	5.0	68.0	0.0

**Walla Walla-North Yakima,
132 Miles.**

		Total Miles	
Miles to		Out	Return
Walla Walla	0.0	0.0	132.0
Sudbury	7.0	7.0	125.0
Divide	13.0	20.0	112.0
Walla Walla	9.0	29.0	103.0
Hoover	4.0	33.0	99.0
Finley	4.0	37.0	95.0
Kennewick	8.0	45.0	87.0
Klona	18.0	63.0	69.0
Prosser	15.0	78.0	54.0
Grandview	13.0	91.0	41.0
Sunnyside	6.0	97.0	35.0
Zillah	14.0	111.0	21.0
Buena	4.0	115.0	17.0
Donald	5.0	120.0	12.0
Yakima	7.0	127.0	5.0
North Yakima	5.0	132.0	0.0

North Yakima-Cle Elum, 72 Miles.

		Total Miles	
Miles to		Out	Return
North Yakima	0.0	0.0	72.0
Pomona	9.0	9.0	63.0
Wenas	18.0	27.0	45.0
Ellensburg	14.0	41.0	31.0
Thorp	12.0	53.0	19.0
Horlick	7.0	60.0	12.0
Teanaway	5.0	65.0	7.0
South Cle Elum	4.0	69.0	3.0
Cle Elum	3.0	72.0	0.0

Cle Elum-Seattle, 114 Miles.

		Total Miles	
Miles to		Out	Return
Cle Elum	0.0	0.0	114.0
Nelson	16.0	16.0	98.0
Easton	7.0	23.0	91.0
Lacoma	20.0	43.0	71.0
Edgewick	18.0	61.0	53.0
Northbend	5.0	66.0	48.0
Fall City	13.0	79.0	35.0
Isaquah	11.0	90.0	24.0
Black River	13.0	103.0	11.0
South Park	6.0	109.0	5.0
Seattle	5.0	114.0	0.0

Motor Car Laws of Interest to Tourists.

State	Registration	With Whom	Fees	Driver	Chauffeur	Requirements	Speed Regulation	Bus, Reg. Out-Maxi-
								Din. Din. side num
Alabama	Annual	Sec. of State, Montgomery	\$7.50-\$20	\$5.00	No examination	Non-Residents	10	15
Arizona	Annual	Sec. of State, Phoenix	\$5-\$15	.....	None	Reciprocity	10	15
Arkansas	Annual	Sheriff of County	\$10	.....	None	Six months	10	15
California	Annual	Mot. Veh. Dept., Sacramento	\$40c H. P.	\$1.00	No examination	Exempt	10	15
Colorado	Annual	Sec. of State, Denver	\$2.50-\$10	.....	No examination	Three months	10	15
Connecticut	Annual	Sec. of State, Hartford	50c H. P.	\$2.00	No examination	30 days	10	15
Delaware	Annual	Sec. of State, Dover	\$3	\$5.00	No examination	Reciprocity	12	12
Florida	Annual	Tax Collector of County	\$3	.....	No examination	Reciprocity	10	15
Georgia	Annual	Sec. of State, Atlanta	\$2	.....	None	30 days	10	15
Idaho	Annual	Assessor of County	\$15-\$40	.....	No examination	Reciprocity	10	15
Illinois	Annual	Sec. of State, Springfield	\$3-\$10	.....	Chauffeur's examination	60 days	10	15
Indiana	Annual	Sec. of State, Indianapolis	\$5-\$20	\$2.00	Examination, chauffeurs only	60 days	10	15
Iowa	Annual	Sec. of State, Des Moines	\$8 up	.....	None	Reciprocity	10	15
Kansas	Annual	County Treasurer	\$5	.....	No examination	Reciprocity	10	15
Kentucky	Annual	Com. of Mot. Veh., Frankfort	\$6-\$20	\$2.00	Examination, chauffeurs only	30 days	10	15
Louisiana	Annual	Com. of Mot. Veh., Baton Rouge	25c H. P.	.....	Examination, chauffeurs only	Reciprocity	10	15
Maine	Annual	Sec. of State, Augusta	\$5-\$15	\$2.00	Examination optional with sec.	Reciprocity	12	12
Maryland	Annual	Com. of Mot. Veh., Baltimore	\$5-\$25	\$2.00	Examination optional for chauffeurs	14 days	12	12
Massachusetts	Annual	State High. Com., Boston	\$5-\$25	\$2.00	No examination	Reciprocity	10	15
Michigan	Annual	Sec. of State, Lansing	26c H. P.	.....	No examination	Exempt	10	15
Minnesota	Triennial	Sec. of State, St. Paul	\$1.50	.....	No examination	30 days	15	15
Mississippi	Annual	State Auditor, Jackson	\$2.00	.....	No examination	60 days	15	15
Missouri	Annual	Sec. of State, Jefferson City	\$2-\$12	\$1.50	No examination	20 days	8	8
Montana	Annual	Sec. of State, Helena	\$2	.....	No license	Reciprocity	12	12
Nebraska	Annual	County Treasurer	\$3	.....	No examination	30 days	12	12
Nevada	Annual	Sec. of State, Carson City	\$3-\$10	.....	Examination	30 days	12	12
New Hampshire	Annual	Com. of Mot. Veh., Concord	\$10-\$40	\$3.00	Examination	10 days	15	15
New Jersey	Annual	Com. of Mot. Veh., Trenton	\$4.50-\$15	\$2-\$4	Examination, chauffeurs only	15 days	12	12
New Mexico	Annual	Sec. of State, Santa Fe	\$2-\$12	.....	None	60 days	12	12
New York	Annual	Sec. of State, Albany and New York	\$5-\$25	.....	Examination, chauffeurs only	Reciprocity	10	15
North Carolina	Annual	Sec. of State, Raleigh	\$5-\$10	.....	None	15 days	10	15
North Dakota	Annual	Sec. of State, Bismarck	\$3	.....	None	Exempt	10	10
Ohio	Annual	Sec. of State, Columbus	\$3-\$5	.....	Examination, chauffeurs only	Reciprocity	8	15
Oklahoma	Annual	High. Com., Oklahoma City	50c H. P.	.....	No examination	Reciprocity	10	15
Oregon	Annual	Sec. of State, Salem	\$3-\$10	.....	No examination	Reciprocity	10	15
Pennsylvania	Annual	State High. Dept., Harrisburg	\$5-\$20	.....	No examination	30 days	10	15
Rhode Island	Annual	State Bd. Pub. Roads, Providence	\$5-\$25	\$1.00	Show knowledge	10 days	15	15
South Carolina	Annual	Clerk County Court	\$1	.....	None	Not exempt	15	15
South Dakota	Annual	County Treasurer	\$3	.....	None	Reciprocity	15	15
Tennessee	Annual	Sec. of State, Nashville	\$5-\$7.50	.....	None	Not exempt	8	15
Texas	Annual	County Clerk	50c	.....	None	Not exempt	8	15
Utah	Annual	Sec. of State, Salt Lake City	\$5-\$15	\$2.00	No examination	30 days	10	15
Vermont	Annual	Sec. of State, Montpelier	\$1 H. P.	\$2.00	Examination optional with sec.	Reciprocity	10	15
Virginia	Annual	Sec. of Commonwealth, Richmond	40c H. P.	\$2.50	No examination	90 days	12	12
Washington	Annual	County Auditors, Charleston	\$3-\$7.50	.....	None	Reciprocity	12	12
West Virginia	Annual	State Auditors, Charleston	\$10	.....	No examination	Reciprocity	10	15
Wisconsin	Annual	Sec. of State, Madison	\$5	.....	None	Reciprocity	15	15
Wyoming	Annual	Sec. of State, Cheyenne	\$5	.....	None	Exempt	15	15
D.C. of Columbia	Perpetual	Auto. Board, Washington	\$2	\$2.00	Examination	Reciprocity	12	15

In connection with the rates of fees in the above tabulation, following addenda will be found important:

Alabama: Under 20 H. P., \$7.50; 20-30, \$12.50; under 40, \$17.50; 40 or more, \$20. Arizona: 25 H. P. and less, \$5; 25-40, \$10; over 40, \$15. California: Electricity, \$5; Colorado: Up to 20 H. P., \$2.50; 21-40, \$5; 41 and up, \$10. Florida: Less than 10 H. P., \$3; 11-29, \$5; 30-40, \$10; 41-50, \$15; 51-60, \$25; 61-70, \$30; over 70, \$50. Georgia: 25 H. P. or less, \$3; 31-40, \$4; over 40, \$5; electricity, \$4. Idaho: 30 H. P. or less, \$10; 31-40, \$20; 41-50, \$25; over 50, \$40. Illinois: 10 H. P. or less, \$3; 11-25, \$5; 26-35, \$6; 36-50, \$8; over 50, \$10; electricity under two tons, \$5; over, \$10. Indiana: Up to 25 H. P., \$5; 26-40, \$8; 41-50, \$15; over 50, \$20; electricity, \$3. Iowa: 20 H. P. or less, \$8; over 20, 40c per H. P.; steam or electric, \$15. Kentucky: Less than 25 H. P., \$6; less than 50, \$11; 50 and over, \$20. Maine: 20 H. P. and under, \$5; 21-35, \$10; over 35, \$15. Maryland: 10 horsepower, \$5; 20, \$10; 30, \$15; 40, \$20; over 40, \$25. Massachusetts: Under 20 H. P., \$5; 20-29, \$10; 30-39, \$15; 40-49, \$20; 50 and up, \$25. Michigan: 25c for each 100 pounds of weight in addition to H. P. rate. Minnesota: \$2 per vehicle and 36c per horsepower; electricity, \$4.80. Missouri: Up to 12 H. P., \$2; 12-23, \$3; 24-35, \$5; 36-47, \$7; 48-59, \$8; 60-71, \$12; 72 and up, \$12. Nevada: 20 H. P. or less, \$3; 21-40, \$5.50; over 40, \$8. New Hampshire: Up to 15 H. P., \$10; 16-30, \$15; 31-40, \$20; 41-50, \$25; 51-60, \$30; over 60, \$40. New Jersey: 10 H. P. or less, \$4.50; 11-29, \$7.50; 30 or more, \$15. New Mexico: Less than 12 H. P., \$2; 12-19, \$4; 20-29, \$6; 30-39, \$8; 40-49, \$10; 50 or more, \$12. New York: 25 H. P. or less, \$5; 26-35, \$10; 36-50, \$15; 50 and up, \$25. North Carolina: Up to 25 H. P., \$5; 26-40, \$7.50; over 40, \$10. Oklahoma: 50c per H. P. first year; 40c second, 30c third, 20c thereafter. Oregon: Electric, \$3 and \$5; others, 26 horsepower, \$3; 27-36, \$5; 37-40, \$7.50; 40 and up, \$10. Pennsylvania: Up to 20 H. P., \$5; 20-35, \$10; 36-50, \$15; 50 and up, \$20. Rhode Island: 15 horsepower and less, \$5; over 15, \$10; over 30, \$15; over 40, \$25. Tennessee: Car for more than four passengers, \$7.50; four or less, \$5. Utah: 25 H. P. and under, \$5; 26-40, \$10; over 40, \$15; electric, \$10. Vermont: First year, \$1 per H. P.; second, 75c; third, 50c. Washington: 25 H. P. and under, \$3; 26-39, \$5; 40 and over, \$7.50.



Top Row, Left to Right: Knox Milan Sailor, Telescope Crown; Price, \$12. Knox Sailor, Ribbon and Buckle Trimmed; Price, \$15. Bottom Row, Left to Right: Bangkok with Hemp Edge, Ribbon Trimmed;

Price, \$12.50. Knox Black Milan Straw, Pencil Edge, Derby Crown; Price, \$13.50. Combination Black Liserette and Leather Brim Sailor, Tailored Rosette; Price, \$24.50.



Sport Suit in Rose Wool Jersey, Featuring a Skirt Which Fastens Down the Front—The Coat Is Mannish in Style, with Pearl Button Trimming.

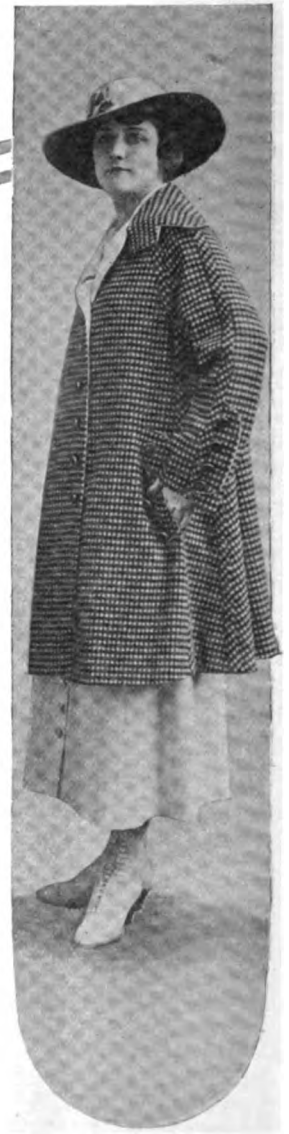


Motor Hat of Black and White Striped Silk with Tabs and Buttons of Self-Material—Motor Veil of White Chiffon May Be Dropped Over Face.

Togs for Tourists.

THERE was a time when the feminine motorist was convinced that any old suit, coat or hat was good enough for motoring. That day has passed, however, the lady who rides now giving as much thought to her motoring togs as to her street costumes. Not only is this evident on the highways of the country, but the tendency is very noticeable among the manufacturers, who this season are offering a larger variety of strikingly smart styles than ever before.

Designing and building motoring garments has become an exceedingly important business, some of the highest salaried designers devoting their skill to achieving costumes that are both attractive and practical. As a result any woman can easily purchase in practically any metropolis the particular style, material and color she has decided upon. On this and the following page are illustrations of the representative designs in outer garments



Sport Coat of Black and White Checked Material—The White Cloth Revere and Narrow White Piping Are Features — Franklin Simon, New York.

A Reis Rubber Coat (Franklin Simon, New York), the Transparent Glossiness and Simple Tailoring of Which Are Interesting Features.



Natural Bangkok with Old Blue Hemp Facing, Old Blue and White Puggree—Price, \$9.



White Bobadine with Colored Brim, Ribbon Trim—Price, \$5.



Sport Hat of Bobadine and Hemp Straw, Fancy Ribbon Band—Price, \$6.



Photographs of Hats by Courtesy of A. Shuman Company, Boston—Other Photographs Are by Joel Feder, New York.



A Franklin Simon (New York) Storm Coat in Pepper and Salt Mixture, the Lines of Which Are Similar to a Man's Raglan.

A Palm Beach Motor Coat Made on Extremely Simple Lines and Simply Tailored—The Reversible Collar and Half Belt Are Distinctive Touches.



Motor Coat Featured in Brown Cloth with Full Skirt and Huge Cape Collar—The Small Rose Velvet Collar Lends an Effective Contrast—Messrs. Revillon Freres.

and millinery being displayed in the smart shops of New York and Boston.

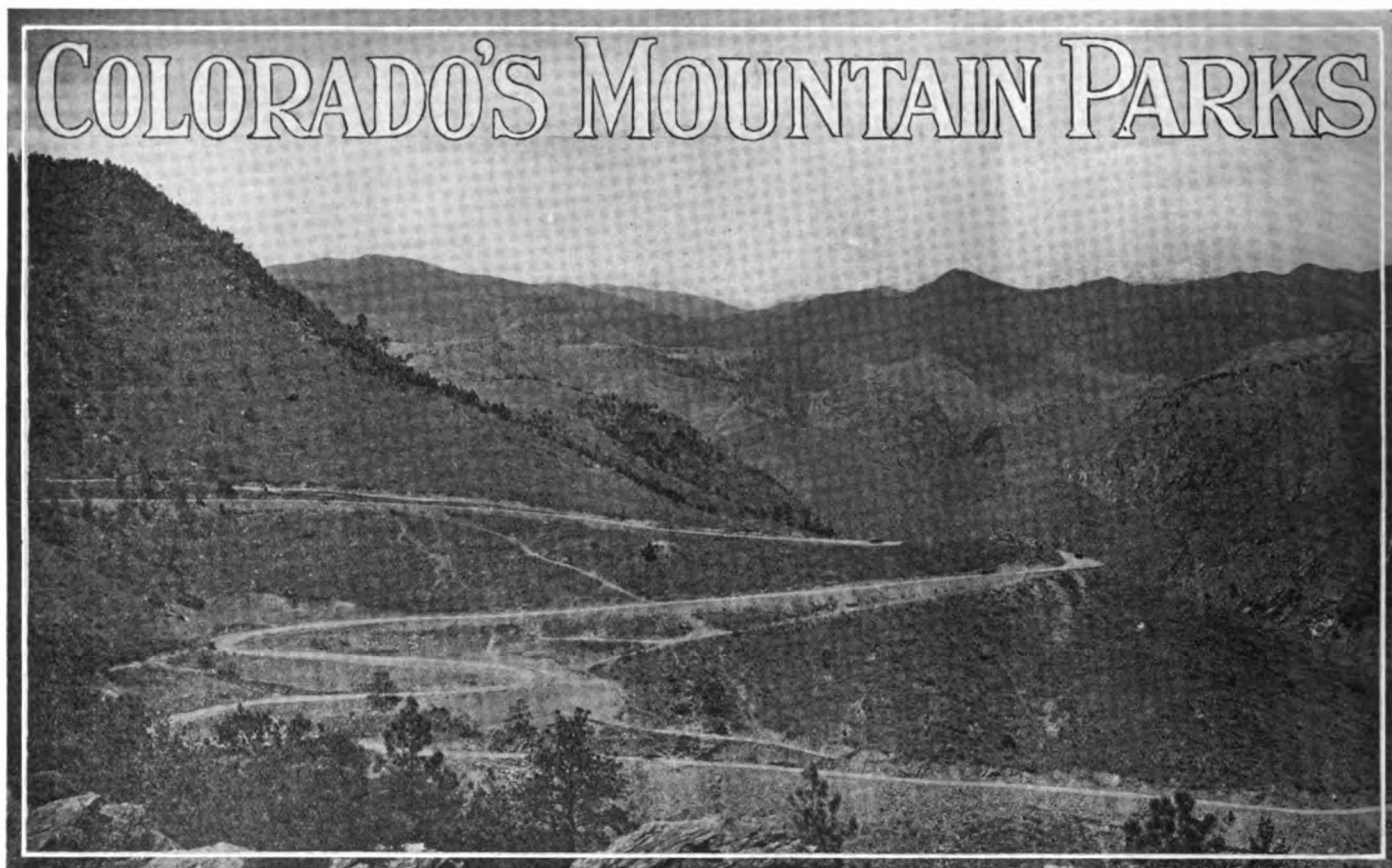
These garments are suitable for the lowlands or the highlands, and for bright sunny days, as well as for rainy days, and are designed to bring out the individual charm of feminine faces and figures. They are quite the vogue and are now being worn by some of the most fashionable women in the motoring world. Some of the garments shown have a dual purpose; they can be worn in the car or they can with propriety be worn upon the streets.

This year the tendency in outer garments seems to be toward looseness, particularly in the long coats. Some designs of sport coats carry out this idea in a very attractive manner, as is shown in the coat on page 52. The full flare back with draw string belt or half belt seems to be one of the more popular styles. In materials Palm Beach cloth is one of the leading features of this season, it being used in coats and suits and in millinery. Black and white checks are still very popular, however, and are made up into quite stylish garments, a sport coat of this material being shown on page 52. Wool jersey is to be found frequently in the shops, one example of a sport suit of this material being illustrated herewith. On page 53 is shown a very modish pepper and salt mixture.

Though motoring hats are generally small and close fitting, the woman who desires a large "floppy" brim can find quite a large variety in the shops. The trend in hats has been toward narrow brims and toward lightness in weight, the milliners concentrating largely upon straws, bangkoks, panamas and silks. The trimmings are of fancy colored ribbons and leather.



Rich Rose Silk Sweater Featuring Broad Sailor Collar and Sash of Self Tone—The Border Effect Is a Novel Detail (Oppenheim Collins, New York).



THE pleasure of motoring through Colorado's mountain parks can be appreciated fully only by those who have experienced the joys of such a trip. With boulevarded mountain roads, many of which are hewn out of solid rock and are perched on the brink of precipitous chasms, tourists who wish to enjoy the delights of mountain climbing without the actual effort usually associated with such pastimes, can indulge themselves by following at least one of the three trips outlined in the following:

In the 1916 Tib Route Book, Colorado section, issued by the Touring Information Bureau of America, are mapped and described in detail all the principal wonderful mountain drives of this mecca for vacationists—drives that lead to Colorado's wonderful mountain parks and mineral springs.

Chief among these mountain top playgrounds is Lookout Mountain park, a scant 20 miles west of Denver. No stretch of road in Colorado offers quite so much scenic grandeur per mile as Lookout Mountain loop, familiarly known as "Engineer's Lariat," which winds its way 1700 feet above the city of Golden. Incidentally, it is also a concrete example of the possibilities of convict labor backing a good roads movement, as it is one of the many Colorado highways built by convicts. A striking view of the "Lariat" is shown at the top of this page.

Another stretch of highway similarly constructed, and regarded by western road men as one of the most important pieces of work in Colorado, is the Coto-paxi Parkdale cut-off, which was in construction at the time Tib cars were traversing the state in 1915. Literally hewn from solid granite, as it is in several places, it leaves with the tourist a

C. Harrison Minor, secretary of the Touring Information Bureau, Kansas City, Mo., prepared this article especially for this magazine, from his own field notes of the district described. The maps and scenic illustrations are significant of those contained in the TIB automobile route book, which presents in one single volume very valuable and exhaustive touring data covering nearly all sections of the country.

The Automobile Journal has been selected among all other motor magazines as the official organ of the Touring Information Bureau, which arrangement affords subscribers opportunity to obtain special touring information in any part of the United States. Readers are urged to write to this bureau at Kansas City, Mo. No charge is made for the service.

picture not soon forgotten. The accompanying illustration shows the convict camp abutting one of the solid granite cliffs that was blasted away.

Denver is known as the "gateway to nine national parks," two of the most important, Rocky mountain and Mesa Verde, being in Colorado, and all of them accessible by automobile over roads which have been covered by the Tib pathfinder cars and mapped.

Seventy-five miles northwest is the New Rocky Mountain National park. Here the striking characteristics of the Rocky mountains are seen at their best, as there are more than 50 peaks stand-

ing in the park, whose summits are higher than 12,000 feet. Trout—brook, speckled and rainbow—lure the fisherman, while the scenic vistas make it a rendezvous for young and old.

Estes park, which has been incorporated in the Rocky Mountain National park, has been pronounced by some Colorado tourists as one of the most interesting in the state, besides furnishing a fine motor tour over an excellent surfaced road. The park cannot be reached by railroad.

Colorado's parks have other attractions besides their scenic settings, as Estes, Boulder, Colorado Springs and Glenwood Springs are famous for their golf links, and the enthusiasts declare that golf is more than "just golf" in Colorado's air.

From Denver to Colorado Springs the road is splendidly maintained, affording fast going, and is among those mapped and described in the Tib Route Book. There is no better known resort in the Pike's Peak region than Colorado Springs, unless it is Manitou, as both afford a wide variety of side scenic auto trips and recreation. The mineral springs of Manitou have been famous for many years.

There is one trip which furnished the Tib pathfinders a variety of scenery and attractions seldom found on any of the resort tours. This is from Colorado Springs to Hartsel, thence Buena Vista and the Twin lakes.

Easy grades characterize the first portion to Hartsel, the route being excellently surfaced. The remainder of the way is somewhat difficult driving, especially in wet weather. The road drains quickly, however. Steep hills are encountered between Buena Vista and

Granite, but from the latter city to Twin lakes it is fairly level. Manitou is the first important resort on this drive, then Cascade and Green Mountain falls, the latter deriving its name from three wonderful waterfalls that drop to the bottom of the canyon over 2000 feet below.

At Florissant, to the west, the geologist will find a veritable paradise of rare petrifications, crystallizations and agate formations. It is a vast natural museum. Close by is Lake George, a picturesque mountain lake in the bend of the South Platte river. Hartsel adds to the list with its hot springs, while Twin lakes, largest in the Rockies, creates in the hearts of fishermen a desire to take up a permanent residence there.

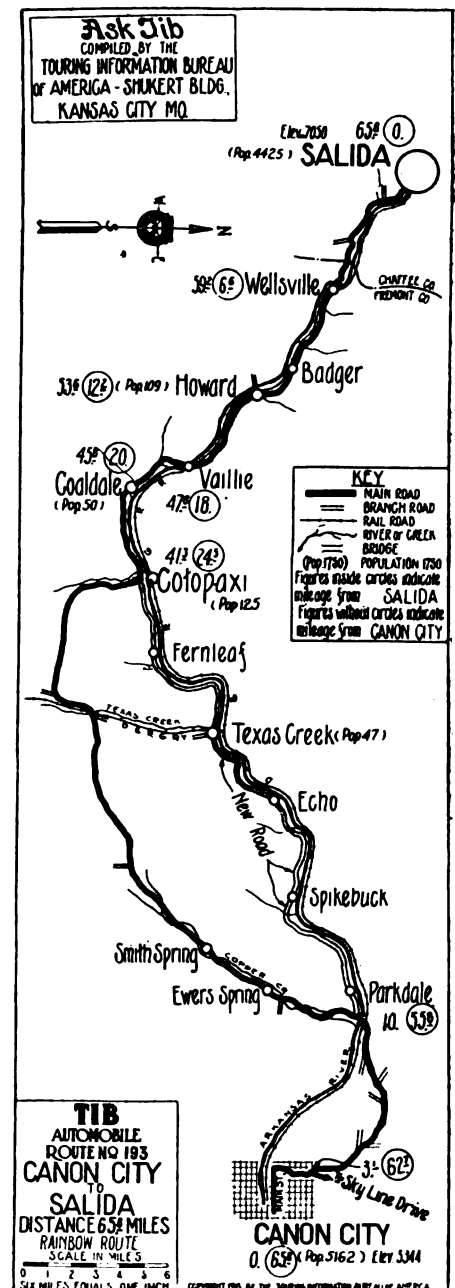
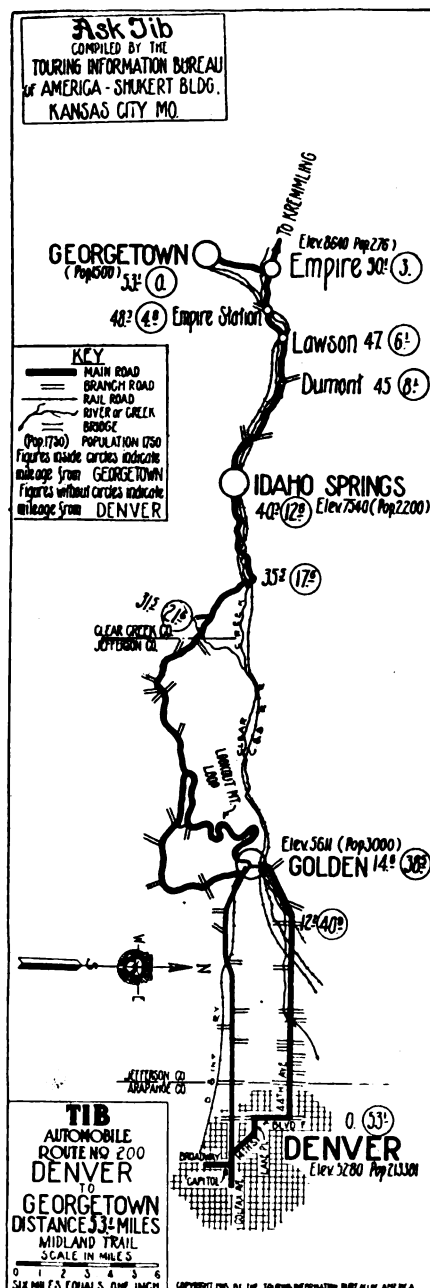
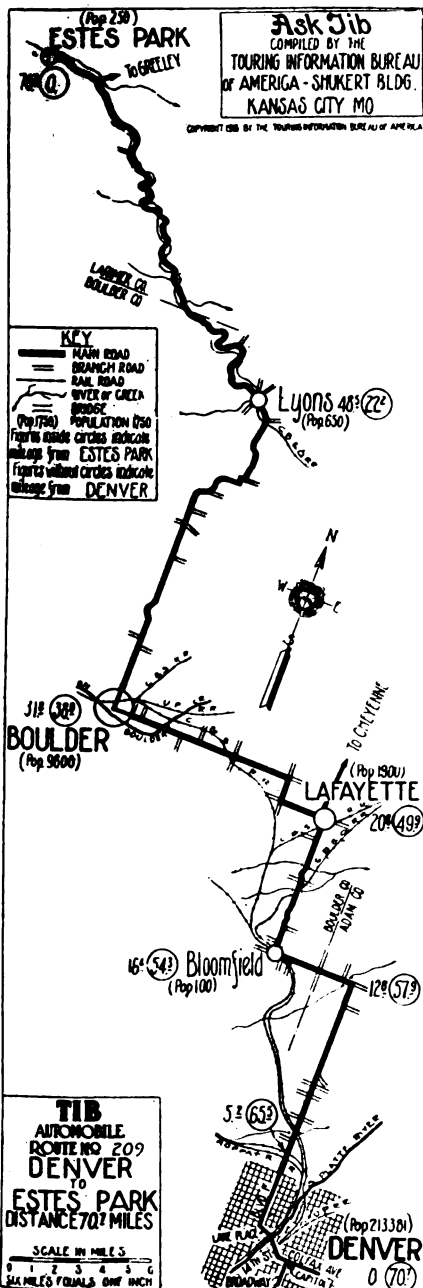
Too often visitors to Colorado, unfamiliar with the western resorts, make a lengthy stay at the well known places in the vicinity of Denver. The completion of the Cotopaxi-Parkdale cut-off has

made it possible for the tourist to motor over comparatively good roads from the Kansas line across the state via Pueblo, Salida, Gunnison and Montrose to Grand Junction. Besides being a popular meeting place for fishermen, fine specimens of bear, elk, mountain lion and deer have been brought down within 40 miles of the Grand Junction, which is an enterprising metropolis at the junction of the Gunnison and Grand rivers. This city is also accessible from Denver over the Midland trail by way of Hot Sulphur and Glenwood Springs, two noted resorts.

The accompanying maps of the described trips are absolutely accurate and vouched for by the Touring Information Bureau of America, Kansas City, Mo. They are designed to take the place of the reading logs in the ordinary route book, by indicating every crook, cross road, dangerous curve, scenic point and other valuable information.

At the present time three Tib path-finding cars, commanded by official representatives, are in the East, mapping Pennsylvania, New York, New Jersey and the New England states as thoroughly in the Tib strip map form as the western states were traversed last year. The results of these path-finding trips will be published in a national and state edition of the Tib Route Book, which will appear early in the spring of 1917. The national edition, covering all the main highways of the entire United States, will retail for \$1.50, the state editions for 50c.

The bureau has a special free information service, open to anyone desiring special routings or directions from one locality to another. A written inquiry to the head office, Kansas City, will procure for the tourist, free of charge, all the data obtainable by the tour directors of the bureau.



Tib Strip Maps Illustrating Three Popular Motor Car Trips to Colorado's Mountain Parks—This Form of Map is a Feature of Tib Touring Books and Make Detailed Itineraries Unnecessary.



MANY owners of automobiles have little conception of the wonderful opportunities they possess for getting the real pleasures out of life. The city owner, when the first warmth of spring brings out the efflorescent foliage in the gardens and parks, longs to get out into the country, where he experiences that mental and physical rest and refreshment that has been denied him throughout the dull months of winter.

Realizing that the automobile is designed to carry its quota of passengers and no extreme excess of load, the manufacturers of equipment, to make the tourist, camper and excursionist comfortable, had to provide some other means of conveying this paraphernalia. Loading it into the cars not only inconvenienced the passengers, but necessarily restricted the amount to a point where the party in order to really enjoy the trip was obliged to go to some public place for meals and to a hotel at night for rest.

When the trailer was first adopted to fill this long felt want it was utilized solely as a medium of transportation, but ingenious minds soon discovered in it the possibility of making the excursion trip into the country one that held forth the realization and materialization of all that could be anticipated. A few minor developments on the trailer idea transformed it into a travelling commissary department, including kitchen and covered and enclosed dining room. In its secondary stage of transformation it was developed into a sleeping apartment that eliminated all the unpleasant features of retiring in the open in sleeping bags or under blankets.

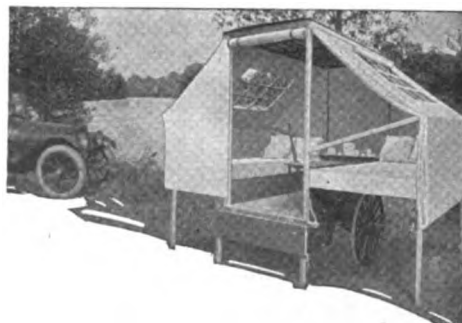
This idea has been carried out and enlarged upon by the different manufacturers of pleasure trailers and there are now on the market a number that should appeal to every lover of outdoor life. Just



At Top of Page Is Shown the Warner Outfit in Use—The Trailer Is Shown in the Small Illustration.

a glimpse of these trailers in the accompanying illustrations seem to stimulate that desire that is inherent in every one for outdoor life. With these opportunities at hand there seems but little doubt that the pleasure trailer will constantly grow in popularity and become of secondary importance to the possession of an automobile.

The trailers, however, are not alone an outing or pleasure proposition, but are so constructed that they can be used for commercial purposes, a service for which they were originally designed before the makers conceived the plan of adapting them to camping and touring



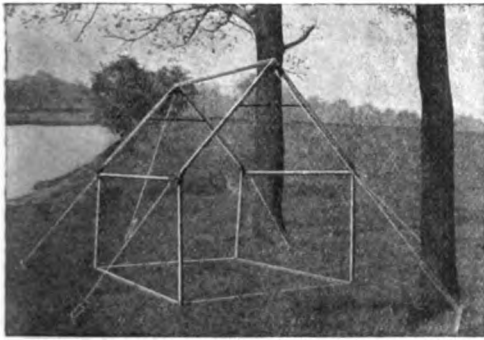
Campmobile Outfit Set Up.

requirements. They vary in capacity according to the make, but are widely used for delivery and haulage purposes by many owners. When not in use for either purpose, however, they are often put into service at home, making admirable outdoor playhouses for children or sleeping quarters for those who desire to sleep outdoors.

Automobile Telescope Apartment.

This great demand from automobilists for accessories and conveniences that make outdoor excursions and camping pleasurable, has also called into being another form of touring equipment which, however, is of a radically different design, being carried on and forming a part of the body of the car. One of these that has been introduced recently is known as the "Automobile Telescope Touring Apartment," manufactured by Gustav de Bretteville, San Francisco, Cal.

A feature of this design is its extraordinary compactness and that it comprises almost everything necessary for the tourist while en tour, it does not extend as far back on a Ford chassis as the regulation touring body, when closed. The touring apartment is of all-steel construction throughout, three feet long, three feet four inches wide and three feet high, and weighs only 175 pounds. One section telescopes within another and two compartments telescope in either side of the moveable section. In this small space, through a unique and ingenious use of the available room, there is contained a folding Pullman berth for two persons, shower bath, ladies' and gentlemen's boudoirs, dressing table, plate glass mirror, writing desk, cooking outfit, gas stove, several chairs with Russian leather seats. When the apartment is opened there is a shelf for books, electric reading lamps and a ventilation system which can be con-



Light but Rigid Gold Medal Tent Frame,
Without Cover.

trolled through the use of glass windows set in metal frames.

A specially designed floss mattress of the latest type is included and there is a container which carries dining china, glass ware and silver. A 10-gallon water tank placed in the roof of the compartment supplies the shower bath and it is so arranged that the water can be passed through the engine radiator to be heated to any desired temperature for either bathing or washing dishes. The stove is connected with the apartment's own gas generator.

The Automobile Telescope Apartment sells for \$112, including the 10-gallon shower tank and exhaust heating attachment, and without this equipment the price is \$100.

Shattuck Convertible Trailer.

The Shattuck Convertible Outing Trailer is one of the most complete on the market. The vehicle itself consists of a body $7\frac{1}{2}$ feet long, 44 inches wide and 16 inches deep, with seats $7\frac{1}{2}$ feet long by nine inches wide. It is supported on full floating ball bearing axles with 34-inch automobile wheels. The equipment includes a khaki duck double filled water proof cover, an awning with a fly, six feet one inch high, which buttons down the front in bad weather; two beds supported on strong posts three feet above the ground, which will comfortably accommodate four grown people. The commissary equipment consists of a well made two-compartment refrigerator, a two-burner gasoline stove and a folding table and shelves for storage. There is also included curtains for beds and mosquito netting windows in small panes. When the whole outfit is set up it covers an area $17\frac{1}{2}$ feet wide by $7\frac{1}{2}$ feet deep and the peak of the tent is eight feet from the ground. It can be set up ready for use in a few minutes and can be packed as quickly. A ball and socket attachment so that it can be fitted to any car is also furnished.

Warner Prairie Schooner.

A. P. Warner is sponsor for a pleasure trailer which is known as the Warner Prairie Schooner, made by the Warner Manufacturing Company, Beloit, Wis. Besides the trailer the main part of the outfit is a large folding tent of khaki duck, water proofed, which when opened covers a space $7\frac{1}{2}$ feet by 14. The tent sets up like an automobile top and is easily pitched in 10 minutes. The other equipment includes two separate folding double Pullman beds with non-sagging

springs and two mattresses. These are so arranged that each apartment is curtained off from the other. An ice chest with two compartments, a folding table and a folding camp stove are also in the equipment, leaving only dishes, linen and food to be supplied to start on a journey or excursion. The trailer, which is of automobile construction and finish, has a capacity of 1500 pounds and comes equipped with either pneumatic or solid tires. The manufacturers claim a speed capacity of 50 miles an hour for the trailer if equipped with pneumatic tires and 15 miles with solid tires. The price of the Warner Prairie Schooner is \$200 equipped with pneumatic tires and \$175 with solid tires.

Campmobile.

The "Campmobile" as its name would suggest, is a combination trailer and equipment for camping and outings. In addition to the trailer, which is a light, yet strong and serviceable vehicle, the equipment includes a tent, two beds with sleeping accommodations for four people, a two-burner gasoline stove, a compact food apartment and a refrigerator. When it is packed and ready for the road, it can be trailed as fast as anyone



Campmobile on the Road.

would care to go, as it has rubber tired wheels running on a $1\frac{1}{4}$ -inch steel axle with ball bearing spindles and the tread is the same as that of the automobile, while there is a new auto coupling of the swivel hitch type that eliminates the danger of accident in towing it. With complete equipment, the Campmobile, which is made by the Cozy Camp and Auto Trailer Company, Indianapolis, Ind., sells for \$165.

While the outfits so far described are

complete units for camping and expeditions into the woods, when the tourist intends to make the trip an extensive one, there are also on the market many little conveniences and accessories that can be used as additional equipment to the trailer outfit or to turn the automobile itself into sleeping quarters. The Auto Bed Company, Bellingham, Wash., makes an auto bed that is being widely used with satisfaction by hunters and fishermen who like to spend the night in their machines without carrying along too elaborate an outfit. Contrary to what might be supposed, this bed is not a hammock, but a warm, comfortable bed, which does not sag in the centre. It will accommodate two people. It is so hung that it does not place any strain on the top of the car. When not in use it rolls up into a bundle four inches in diameter and two feet long and can be packed readily in the smallest car. The beds designed for Ford cars sell for \$7.50; for larger cars the price is \$8.50. This same concern also makes an auto tent, which has many advantages over the ordinary type. It can be erected on either side of a car in a few minutes and requires only one light pole. The tents sell at \$8.50 and \$10.50 in accordance with the size.

There are many other things that come in handy to the auto touring, such as extra folding beds, chairs and cots or folding bath tubs, which prove great conveniences; also canteens and water bags, folding wash stands and water pails. A full line of this type of equipment is manufactured by the Gold Medal Camp Furniture Company, Racine, Wis., and their product is extensively used by the United States government in its military and naval departments. This company also manufactures folding tent frames, which are widely used, not only for outing purposes, but as canvas garages, the frames being so arranged that when the tent is pitched there is no centre pole in front to interfere with driving the automobile in or out.



Automobile Telescope Apartment Opened, the View Illustrating How It Can Be Used While on the Road.



THE McFarlan Motor Company, Connersville, Ind., announces another new model 90 car for the coming 12 months, the price of the touring car being \$3200. The company has restricted its efforts to one chassis equipped with a six-cylinder motor having a $4\frac{1}{4}$ -inch bore and six-inch stroke. This new 90 is a refinement of the McFarlan series X which has been built for several years.

The general appearance of the new car differs from previous models in that it hangs almost four inches lower, the top of the body panel being only 48 inches off the ground. This result has been achieved without lessening the road clearance, however, and the body is roomier and carries the passengers lower than before. The front compartment is exceptionally roomy.

True Streamline Body.

The body is of the true, double cowl, streamline design, with the exception that the front backs are raised slightly out of this cowl to allow a higher and heavier upholstering than has been employed formerly. The same practise has been followed out in the rear seat, the raise, however, being completely hidden by the back curtain and back stays, which are carried around the corner of the body. Consequently, while the car from the outside seems to have a very low back, the trimming on the inside extends from four inches above the line to the body proper. The windshield has been slightly slanted, and the characteristic McFarlan ventilators in the top of the hood have been retained, doing away with the necessity of ventilating the front compartment.

The auxiliary seats are folded into a cabinet built into the double cowl and when not in use are completely hidden by flexible wooden curtains which draw down over them. Between the seats is a built-in compartment capable of holding a pair of quart thermos bottles.

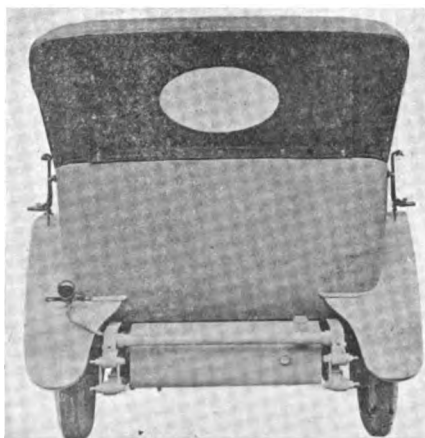
Very heavy door locks have been especially designed for these bodies. They are controlled by means of a lever handle lying parallel to the top of the door and releasing in either direction, but are entirely hidden when viewed from the outside.

The control remains practically the same as last year, with the exception of electrical equipment, which has been centralized in a control box on the steering column. All wiring is in the chassis, with the result that it is necessary to pull out only two connectors when changing from touring to the closed type of body.

The steering wheel is arranged to tilt out of the way, which affords utmost ease in entering the car on the left side. The wheel segments can be heated for winter driving, they being connected with the general electrical system of the car.

Entirely New Frame.

There is an entirely new frame used in this McFarlan model. It is drawn in at the front to afford a short turning radius and tapers back to a width of 40 inches, beginning in the middle of the front door, thus supporting the body directly under the sills. The frame is straight with the exception of a kick-up over the rear axle, after which the rear horn of the frame returns to the same level as the front. The springs are semi-elliptic front and rear, the front length being 40 inches and the rear 64 inches, which insures ease and comfortable riding for passengers.



Rear of the McFarlan 90, Showing Large Spring Shackles and Construction of Fenders.

The motor is the same bore and stroke as the former McFarlan model, $4\frac{1}{4}$ by six inches. The connecting rods, however, have been considerably lengthened to avoid side thrusts and the angle of the half time gears has been increased with extremely good results. Main bearings are lubricated under a pressure varying from five to 30 pounds at different motor speeds. The connecting rods and cylinders are taken care of by the Teetor system of variable level splash controlled by gravity.

The motor is a T head type, with the spark plugs directly over the centre of the pistons. Both the intake and the exhaust valves are inclined towards the centre, greatly reducing the width of the explosion chamber. The exhaust manifold, formerly an integral part of the cylinder casting, has been brought outside of the cylinder and increased to $3\frac{1}{4}$ inches in diameter. The Piel cut-out is fitted regularly, giving an absolutely open exhaust when wanted. The compression has been raised from 60 to 70 pounds.

The electrical equipment is Westinghouse throughout. The generator and ignition system are mounted on the left hand side of the motor and the starting motor at the rear on the right hand side, starting being accomplished through the flywheel. The starting mechanism is controlled by means of a button, located on the centralized control board, which actuates the magneto switch mounted in the chassis.

The cone clutch that has been used for several seasons has been replaced by an extremely large three-plate clutch, with asbestos facing operating against steel and running dry. The leverage has been increased until not more than six pounds pressure is necessary on the foot pedal to operate the clutch.

The transmission is identical with former McFarlan practise, the gears being Brown-Lipe and the entire unit being mounted on Timken bearings.

Both front and rear axles are Timken make, the rear being full floating and driven by spline shafts. The propeller shaft is tubular, with a joint at the rear

axle, as well as on the front of the shaft and between the clutch and transmission. These are Spicer joints.

The brake drums have been enlarged to 17 inches in diameter and $2\frac{1}{2}$ inches wide, and the wheelbase on all models has been increased to 136 inches. Likewise, the gasoline tank at the rear has been enlarged from 22 to 30 gallons capacity. The spare tires are now carried in a stamped basket, spread completely across the rear of the chassis instead of on small pads as used on previous McFarlan models. The fender construction, with angle iron edge, has been retained.

Regular equipment includes 35 by five-inch cord tires, Firestone demountable rims, Boyce motometer and Hartford shock absorbers all around. The tool equipment is very complete and includes a Hartford jack.

EMERSON FOUR FOR \$395.

The new Emerson Four, designed by R. C. Hupp to sell for \$395, is the latest automobile creation to be announced. The car will be built by a new concern, the Emerson Motors Company, which was incorporated in Delaware with a capital of \$10,000,000.

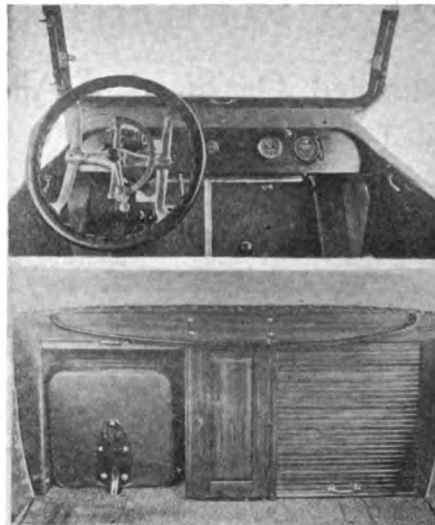
R. C. Hupp is vice president as well as engineer of the company. T. A. Campbell, formerly treasurer and general manager of the Imperial Automobile Company, and George N. Campbell, formerly secretary and factory manager of the same concern, hold the positions of president and treasurer respectively. M. L. Shanks, formerly secretary of the Monarch Motor Car Company of Detroit, is assistant secretary. Jessie R. Leonard of Pittsburg, prominent as a director of the Columbia National Bank of that city, is a member of the directorate.

It is claimed that the Emerson Four, which is the one type of car to be built, will have the most beautiful lines that have ever been designed in a car selling at the price; that the engine is built along standard and practical lines, powerful enough to take the car over steep hills and rough roads and that it is the lowest priced five-passenger car ever offered to the American public.

Markets for the new car will be sought in Europe, as well as in this country. Much interest has been centred in the new corporation, owing to M. R. Hupp's connection with it, as he has long been an enthusiastic advocate of a low priced car to be built on standardized scale and in large volume.

KING MODEL E.

Following the policy of previous years, the King Motor Car Company will make no mid-year announcement of new models or prices. In accordance with its custom declarations of this character will be made immediately before the New York Automobile Show, which takes place during the early part of January. In a statement issued by Artemas Ward, Jr., president of the King company, which has been sent out to dealers, he announces that the eight-cylinder model E will be continued without substantial change, although the improvement and



At Top, Front Compartment, Showing Control Unit Under Steering Wheel; Bottom, Compartment Into Which Auxiliary Seats Fold.

refinement of both mechanism and coach work will go on constantly. Mr. Ward further states that, "Although 14 of the leading American car manufacturers have increased their prices since the first of the year, the King company, by anticipating the present condition of the material market, has been able to continue with the originally announced price of \$1350."

NEW MODEL OVERLAND.

The Willys-Overland Company has disclosed a new series of the smaller four-cylinder Overlands originally brought out last fall as model 75. The new car is designated as 75B and differs in major details in that the bore has been increased from $3\frac{1}{8}$ inches to $3\frac{3}{8}$ inches, the stroke remaining at five inches.

There are several other refinements of a character that add to the efficiency of

the power plant, and the motor now develops 31.5 horsepower at 1950 revolutions. This increase of power, together with the other refinements, make the car well worth the advance in price over the 75 series. The price of the 75B touring car, five passengers, is \$635, and the roadster \$620. The 75 series touring car sold for \$615 and the roadster for \$595.

This newly announced Overland model has wheelbase of 104 inches, cantilever springs, gearset incorporated with the rear axle, tapered frame, 31 by four tires, and is equipped with Auto-Lite starting and lighting.

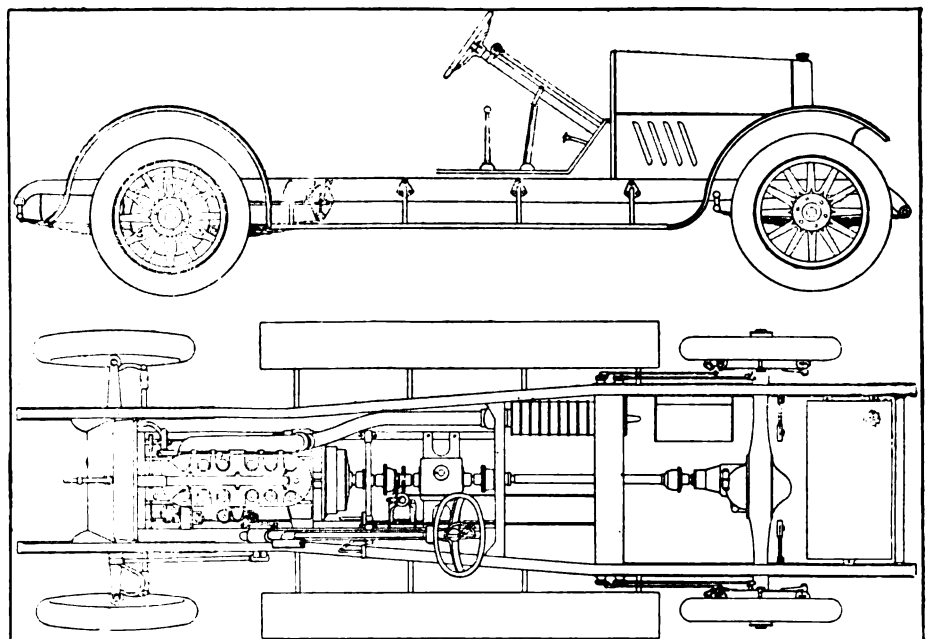
The body resembles the other series, and there are the same Overland conveniences, such as electrical control box on the steering column, one man top, demountable rims and all the other equipment and accessories of present day automobile practise.

MERCERS IN CARNIVAL.

At a recent carnival, in which moving picture actors and actresses figured prominently, at the Ascot speedway, Los Angeles, Arthur Hansen won a 10-mile race in a Mercer car, for which he was awarded the Barney Oldfield trophy, and also proclaimed the "Amateur Film Champion of America." Dorothy Dalton, driving her own 22-72 Mercer, won the high honors in the beauty show parade, which was a feature of the carnival.

WILMO BOUGHT BY GILLETTE.

The Wilmo Company, Chicago, and the Amplex Auto and Machinery Company, Mishawaka, Ind., have been purchased by the Gillette Motors Company and the new address of the combined concerns will be the Gillette Motors Company, Mishawaka. All products of the new company will carry the brand and trade mark of "Wilmo." King C. Gillette is president.



Two Views of the McFarlan Stripped Chassis, Which Show the Absence of Torque Tube and the Low Hang of the Car.

ALLEN BRINGS OUT A ROADSTER.

Two Passenger Car To Be Mounted On Standard Allen Model 37 Chassis---Price \$795.

THE Allen Motor Company, Fostoria, O., recently announced an unusually attractive two-passenger roadster, which is not only distinctive from outward appearances, but is attractive through its mechanical construction. The body is of pure stream line design and is mounted on the standard Allen chassis, the same as is used for the five-passenger touring car.

Particular attention has been devoted to the comfort of passengers, the seats being provided with extra deep cushions; they are sufficiently wide to accommodate two adult persons and a child without cramping. A commodious and accessible rear deck compartment is another feature, it allowing plenty of room for travelling bags, instruments and salesmen's sample cases, in addition to the tools and loose equipment, which makes the car particularly adaptable to the uses of business and professional men. The door opens wide and is water and dust proof.

The unit power plant used incorporates the 37 horsepower long stroke Allen motor of four cylinders, 3 $\frac{1}{4}$ by five inches, cast en bloc. Westinghouse ignition, as well as electric starting and lighting systems, are used. The cooling system is the thermo-syphon type, with tubular radiator of large capacity and belt driven fan.

The Stewart vacuum system is employed in supplying the gasoline from the tank suspended in the rear, and carburetion is by a special model Stromberg carburetor. The clutch is an unusually easy working cone type, and the transmission gearset is selective, with three speeds forward and reverse.

The wheelbase of the chassis is 112 inches, an unusually long type for a roadster of this class and price. This wheelbase, coupled with 55-inch under-

slung rear springs, is intended to insure easy riding, an especially spacious body and ease of operation in practically any road conditions to be met.

All instruments are mounted on the instrument board in the cowl dash and include electric switches, ammeter, carburetor, adjusting knob and speedometer. The horn button is conveniently located on the top of the steering wheel column. Steering is from the left hand side, with control levers in the centre.

The body is finished in olive green, as are the wheels, while the radiator hood, fenders and running gear are black enamel. The standard equipment includes clear vision windshield, top, Firestone demountable rims and non-skid tires on the rear.

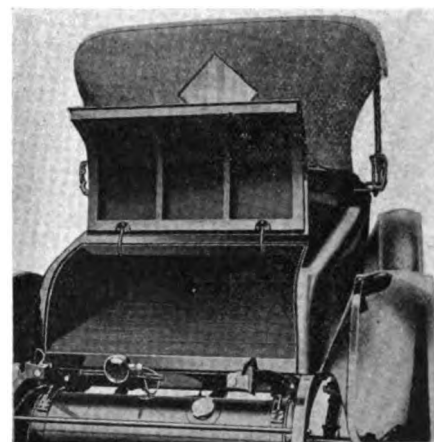
The new Allen roadster is an exceedingly well designed and constructed car, and is priced at \$795.

Model 37 Continued.

Simultaneously with the announcement of the roadster, the Allen company also made public its intention to continue its model 37 touring car through the 1917 season with no changes. For a light, roomy, four-cylinder car of moderate price the Allen gained widespread popularity during the past year and as the car is up to modern standards in both design and construction, no necessity was felt for altering its general lines or power plant. The price of \$795 will also be continued, but will be contingent upon conditions in the materials market.

NO CHANGES IN 1917 MARMON.

The Nordyke & Marmon Company of Indianapolis has announced that there will be no changes of importance in the "Marmon 34" for 1917. The present model, which was introduced at the New York Automobile Show last January and



Rear Deck Compartment for Travelling Bags, Etc.

proved one of the biggest surprises on account of the extensive use of aluminum in its construction and the low set of the body, will be continued indefinitely. It has always been a policy with the Nordyke & Marmon Company, which is one of the oldest machinery companies in America, to make changes in its models only when such changes were made advisable by new and accepted developments in automobile engineering. The company has never made alterations in its product for the sole purpose of giving it a talking point.

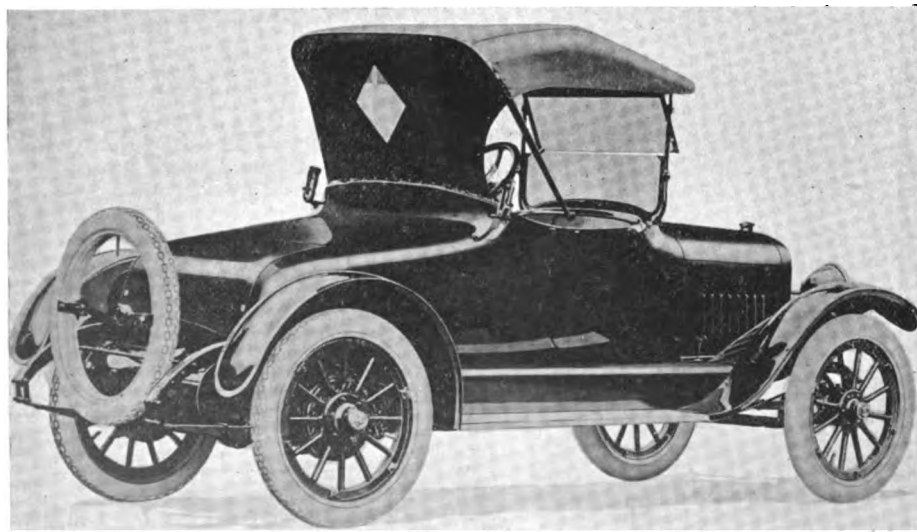
No strength at any point has been sacrificed however, to gain this advantageous point of lightness, aluminum being used only where scientific experiments have proven its reliability. One of the most salient features is the rangy appearance of the car, which is due to a low hung body. By the use of a deep frame section and running boards that are practically integral with the frame, the use of a heavy body sill is eliminated and permits placing the body directly upon the frame. Aluminum has been used largely in the make up of the motor, which is of the most efficient valve in head type.

The Marmon factory was enlarged last year, but even with the increased capacity provided the company has not been able to keep up with the demand. A further increase in the facilities at the plant will be made, however, so that a much larger production will be possible.

FOSTORIA CARS FOR 1917.

The Fostoria Light Car Company has made its announcement for 1917, disclosing the adoption of a full floating rear axle, Remy ignition with distributor and automatic sparkler and the location of control instruments on a natural wood cowl dash. The front seat has been increased in width from 37 to 42 inches and the rear from 39 to 46 inches.

The price of the touring car has been advanced to \$735; the delivery wagon, with an open body to \$695, and with a closed body to \$715. In addition to the changes enumerated above there have been many minor refinements made throughout the entire chassis, which will make the 1917 models much improved over last year's cars.



The New Allen Two-Passenger Roadster for 1917.

USEFUL ACCESSORIES FOR THE MOTOR CAR TOURIST.

Shanhouse Motor Garments.

A good garment that can be slipped on to cover the person from neck to shoe tops is quite essential while touring, as it is not customary to carry many changes of clothes. When tire changes have to be made or other repairs looked after, such a garment saves the clothes. An ideal suit of this kind is manufactured by the Shanhouse Company, Rockford, Ill. It is after the style of a suit of overalls except that it combines a jacket with the trousers. In ordering give chest and leg measurements.

Weed Anti-Skid Chain.

The tire chain is still the accepted form of anti-skid device and also for maintaining traction on slippery road surfaces. Through its use many accidents are avoided and it is a cheap precaution against overturning and collisions. The Weed chain manufactured by the American Chain Company, Inc., Bridgeport, Conn., is one of the most popular of these devices and has a reputation for durability.

Walden-Worcester Wrench Set.

Nothing is quite so essential on an automobile as a good set of socket wrenches. To meet this demand the Walden Manufacturing Company, Worcester, Mass., has put on the market a set including 31 assorted steel sockets, extension bar, universal joint and three ratchet wrenches, an equipment that can handle practically every nut and bolt on an automobile. This set is known as No. 10 and retails for \$10. The same firm also manufactures other sets, one retailing for \$4.

Warren Motor Restaurant.

The Warren Leather Goods Company, Worcester, Mass., manufactures a luncheon set for automobilists known as the "Warren Motor Restaurant," which supplies every need of those going into the country on a picnic or for touring purposes. The dining utensils, which consist of knives, forks, spoons, plates and cups for a party of five, are neatly arranged in place in a wooden box covered with black enameled duck, which also contains two food boxes, two glass jars and a space is provided for two vacuum bottles. The case occupies a space 19½ inches by 14 inches by six inches.

Hayes Folding Bucket.

A dual purpose folding water bucket,



Shanhouse Motor Garments.



Stearns Emergency Case.



Walden Worcester Wrench Set.

manufactured by the F. C. Hayes Company, Altamont, N. Y., has many advantages for the camping motorist. Besides affording a convenient means of filling the radiator or securing drinking water out of a brook or pond, it can be used as a game bag or for carrying other things, a handle being readily made by passing a rope through the two eyelets that are provided in the sides. The bucket has a capacity of over a gallon and when folded measures 3½ by 10½ inches. The retail price is 75 cents.

Detroit Gearless Pump.

One of the most convenient automatic tire pumps on the market, which is adapted to cars equipped with self-starters, is the Detroit gearless tire pump. It is small and compact and can be attached to the crankshaft in a few seconds. When not in use it can be carried in the tool box. It is guaranteed to pump a stream of air free from oil spray. The Detroit Accessories Corporation, Detroit, Mich., is the manufacturer.

Stearns Emergency Case.

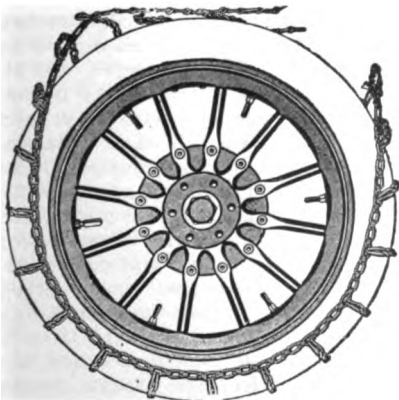
When touring in the country help is not always at hand in cases of accident, a fact which makes the possession of a medicine kit at all times in the car an important part of the equipment. Frederick Stearns Company, Detroit, Mich., manufactures a kit called the "Stearns Emergency Case," which contains various medicines that are necessary in emergency and also ointment, absorbent cotton, surgeon's plaster, court plaster and gauze bandages. The retail price is \$1.50.

Williams' Demountable Rim Tool.

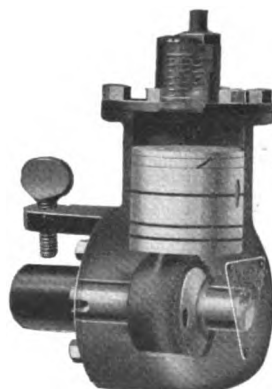
One of the most unique and convenient demountable rim tools on the market is that manufactured by the J. H. Williams Company, Brooklyn, N. Y. This tool combines a wrench, hammer and tire tool in one piece. It is strong, well made and with it the operation of changing rims can be accomplished very rapidly. It is made of drop forged steel, with the wrench sockets of different sizes to fit ½, 11/16 and ¾-inch hexagon nuts. It sells for \$1 each.

Wilmo Manifold.

Introducing superheated gas mixture into the cylinders means better ignition and economy of fuel. When a means is obtained to perform this function a posi-



Weed Anti-Skid Chains.



Detroit Pump.



Hayes Bucket.



Warren Motor Restaurant.



Cut Away View Wilmo Manifold.

tive carburetion is secured even with low grades of gasoline. An excellent device to heat the gas charge before entering the cylinders is the Wilmo manifold, which has a secondary chamber, through which the exhaust gases from the engine pass and heat the charge as it goes on its way to the firing chamber. It not only increases the amount of power derived from a given amount of gasoline, but increases the flexibility of the motor. The Wilmo manifold is manufactured by the Wilmo Company, 208 Fulton street, Chicago, Ill.

Twin Rim.

The Twin Rim, manufactured by the Twin Rim Company, 103 Massachusetts avenue, Boston, Mass., is being widely used by owners of Fords, Maxwells, Metz and other makes with 30-inch clincher rims. The Twin Rim when equipped with a tire can be used in an emergency on any of the four wheels without disturbing the regular rims or tires. It is attached in a few minutes as an auxiliary wheel, the placing and tightening of four clamp bolts being all the fitting required. The list price is \$5.

Pyrene Extinguishers.

When an automobile or garage catches on fire the attendants must work quickly. He should have a standard fire extinguisher immediately handy. In a garage they should be on the walls; when touring at least one should be included in the equipment. The most convenient size for the latter use is the Pyrene of quart capacity, which is manufactured by the Pyrene Manufacturing Company, Boston, Mass., and New York City. This size sells for \$7.50 with a bracket to install it in a convenient place on the car.

Clero Hand-Operated Horns.

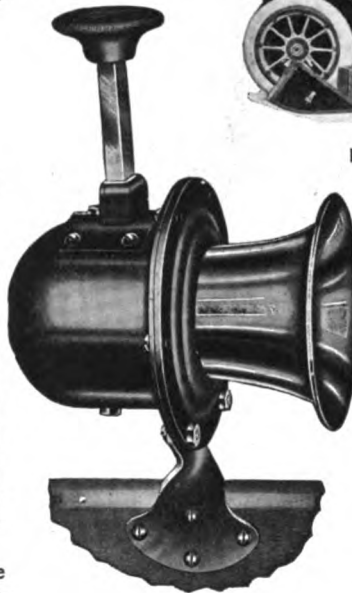
The Clero hand-operated horns, manufactured by the Fitzgerald Manufacturing Company of Torrington, Conn., are not only low in price as compared with similarly constructed devices, but they have advantages in a number of respects over other makes. The range of tone is a particular feature, the warning signal being raised from a low, clear tone to be used in traffic, up to a piercing shriek when a penetrating and far reaching warning is to be sent out. The volume of sound is regulated by the pressure on the operating knob. One type with a short horn is sold at \$3.50 and the longer horn type is sold at \$4.

Dover Saval Measures.

Many dollars are wasted in the course of the year in handling oils in old fashioned measuring utensils. Ordinary lipped measures not only cause waste in introducing the lubricants into the oiling systems, but have no means of controlling the flow. The Dover-Saval meas-



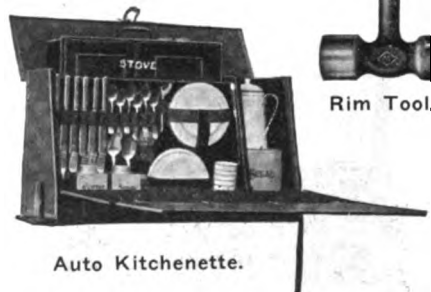
Pyrene Extinguisher.



Clero Horn.



Dover Measure.



Auto Kitchenette.



Rim Tool.



Attaching a Twin Rim.



Kamlee Packard Touring Outfit.

ure, which has a funnel at the top instead of a lip, permits of pouring the oil directly into the tank without spilling any, and, with the plunger valve, with which the funnel is equipped, the flow can be stopped immediately. These measures are manufactured by the Dover Stamping and Manufacturing Company, Cambridge, Mass., and are made in three sizes, selling at \$1.25, \$1.50 and \$1.75 respectively.

Auto Kitchenette.

A convenient portable kitchenette adds greatly to the pleasures of a trip into the country. The Prentis-Wabers Manufacturing Company, Grand Rapids, Mich., has combined in its product the Auto Kitchenette, all the necessary utensils and equipment to cook and serve a meal while en tour.

The largest size outfit, designed to serve a party of six persons, includes a No. 1 Moat folding gasoline stove, fitted with two burners and an oven, two stew and two frying pans, one bake dish, one 12-inch platter, six dinner plates, cups, knives, forks, spoons, a butcher and kitchen knife, two-quart coffee pot, one flour or bread box, coffee and sugar canisters and salt and pepper shakers. The whole outfit goes into a case 17½x28x12 inches and weighs 75 pounds. This outfit sells for \$37.50. The outfit to serve four persons sells at \$26, while the deluxe outfit sells for \$50. The latter consists of aluminum utensils, 12 cwt. silver plate knives, forks and spoons and white enamel dishes. A two party outfit is also made.

Kamlee Packard Touring Outfit.

Probably the most complete outfit made for carrying the tourist's luggage is that manufactured by the Kamlee Company, Milwaukee, Wis. It is known as the Kamlee Packard Touring Outfit. The trunks are made in different types to fit various makes of cars. The Packard outfit is built in eight units as follows:

Left running board trunk; contains two suit cases; has rubber mat on top; to be bolted to running board; price, \$82.25. Upper left running board trunk; fits on top of No. 1; attached with locks and straps; contains two suit cases; has water proof cover over entire trunks; closes left doors when in position; price, \$88.25. Right running board trunk; contains one suit case; has water proof cover over entire trunk; rubber mat on top; located directly under front door; price, \$59. Left fender trunk; for chauffeur's use; door in front; straps and attachments for carrying No. 6 or other luggage on top; price, \$35. Right fender trunk; for chauffeur's use; door in front; straps and attachments for carrying No.



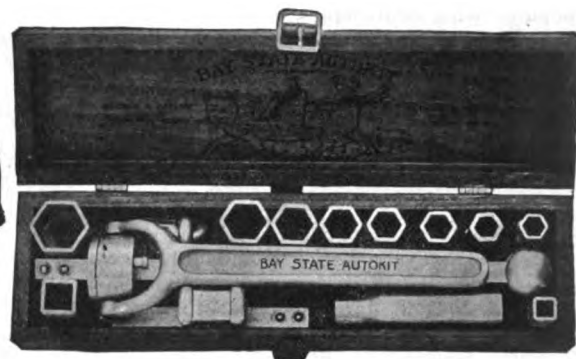
Se-Ment-Oil.



Dover Lamp Case.



Baseline Autoline.



Bay State Autokit, a Complete Wrench Set.

7 or other luggage on top; price, \$35. Large suit case; enclosed in water proof cover; fits on top of No. 4 fender trunk; price \$33. Two suit cases enclosed in water proof cover; to be attached to right fender trunk; price, \$33. Special designed tire drum, carried in spare tires at rear of car; has inside tape arrangement for carrying hats or can be used for general purposes; price, \$26.50.

Stevens Compound Pump.

The Stevens compound pump, manufactured by Stevens & Co., 272 Broadway, New York City, is one of the most efficient hand operated pumps for automobile tires on the market. It has a special arrangement making it possible to maintain 200 pounds pressure. The Stevens No. 99 pump has two cylinders and a long lever handle, making pumping easy. One cylinder has a bore of $3\frac{1}{2}$ inches. The air is first compressed in this cylinder and then passes to the second, which is two inches in diameter. After the second compression the air passes to the tire or tank. With three feet of high grade hose and improved Acorn connection, the price is \$12. A pressure gauge attachment is \$1 extra.

Dover Electric Lamp Case.

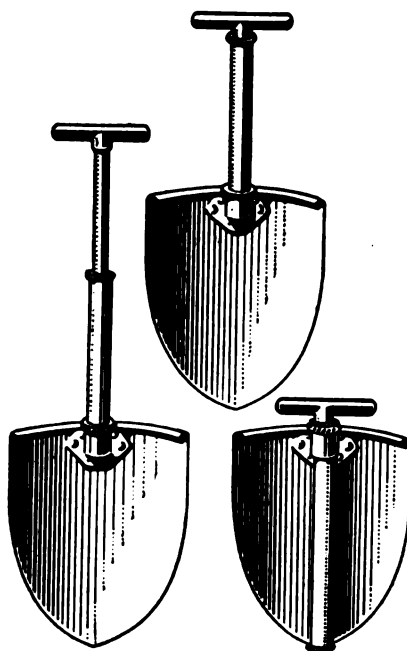
The Dover Stamping and Manufacturing Company, Cambridge, Mass., is making a special design lamp case which not only preserves the glass bulb, but prevents the breakage of filaments through vibration. These cases are made of steel without seams and will hold two headlight lamps, two side light lamps, one speedometer and one tail light lamp, all of which are securely held in place by brace springs and a locking device. The cases retail at 75 cents.

Baseline Autoline.

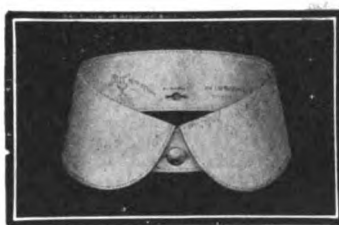
The Baseline Autoline, manufactured by the Broderick & Bascom Rope Company, St. Louis, Mo., meets the requirements of an ideal tow line. It combines strength and convenience, being made of yellow strand power steel wire woven into a quarter inch rope and is equipped with a steel hook at each end. Two half-inch manila rope slings are included in the equipment to facilitate rapid attachment to an automobile. The price of the Baseline Autoline complete is \$3.95.

Bay State Autokit.

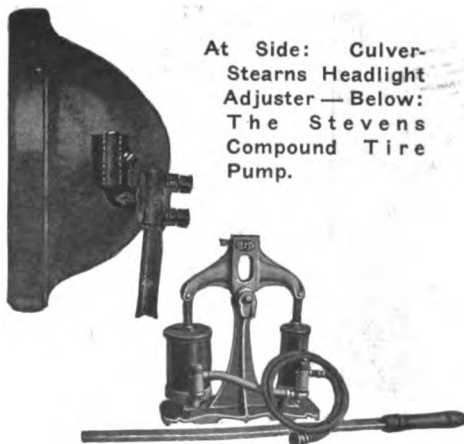
The ideal wrench set is one that will reach and fit every nut on the automobile and in addition to a wide assortment of sockets the handle should be of a design that can be worked at any an-



Ideal Tourist Shovel.



Motorists' Waterproof Collar.



At Side: Culver-Stearns Headlight Adjuster—Below: The Stevens Compound Tire Pump.

gle. The Bay State Autokit meets these requirements. The No. 1 sets, which have 31 sockets, with a swivelling, reversible ratchet handle, are contained in specially built cases and sell at \$10. A No. 2 set, with 12 sockets, sells for \$7.50, and a No. 3 set, designed specially for Ford cars and has 11 sockets, sells for \$4. George A. Cutter, Taunton, Mass., is selling agent for the Bay State Auto Kit.

Ideal Tourist Shovel.

It often happens that while en tour a shovel comes in handy in digging out a ditched wheel or for some other purpose, but owing to the proportions of an ordinary shovel it does not readily fit with the everyday equipment of an automobile. To overcome this objection the Ideal Manufacturing Company, North Kansas City, Mo., has designed and put on the market a folding tourist's shovel, which, when the handle is telescoped, measures less than a foot in length and weighs but two pounds. It may be readily carried in the tool box. A descriptive circular and prices will be sent upon application to the manufacturers.

C-S Headlight Adjusters.

To insure that the headlights will conform to the new regulations in many states regarding the height and glare of the light thrown ahead of the car, a Culver-Stearns headlight adjuster may be used. It allows the headlights to be tilted forward to an angle that makes the beam of light conform to the law and still retain the full volume of illumination. The adjusters consist of four adjustable auxiliary supports mounted between each lamp lug and the prop and they can be used on any lamp that is mounted on a forked prop. There are two types manufactured by the Culver-Stearns Manufacturing Company, Worcester, Mass. Type A is designed for lamps that have set screws in the lugs and type B for lamps which are held in position with a cap nut. The adjusters sell at \$2 per set.

Water Proof Collars and Cuffs.

The Arlington Company, 725-727 Broadway, New York City, is manufacturing waterproof collars and cuffs known as the Challenge Brand, which is considered the finest quality in this kind of a product. They are not like the old fashioned rubber collar, but are designed after the very latest styles and in fit and finish have the appearance of a high

grade linen collar. These are becoming popular with motorists who have to get out and make an occasional repair underneath their machines, as when either cuffs or collar are soiled they can be made immaculate quickly with a little water on a sponge or cloth. The Arlington Company makes six different brands of these goods, covering all sizes.

Se-Ment-Ol.

Radiator leaks lose their terror to the man who has a can of "Se-ment-ol" in his tool box, as with this preparation it is a matter of but a few seconds to stop up the hole.

The Se-ment-ol method is very easy and quick, the preparation being poured into the radiator where it mixes with the water. When it has circulated to the leak it becomes congealed upon contact with the air, forming an effective, permanent plug in the hole. After the leak is stopped the radiator is flushed with fresh water to remove the surplus cement. The preparation, which is one of the products of the Northwestern Chemical Company, Marietta, O., comes in large cans, which sell for 75 cents each.

Atlas Robe Rail Bags.

The Atlas Specialty Manufacturing Company, Chicago, Ill., in introducing a robe rail bag has supplied a long felt want. The Atlas bag does not interfere with the use of the rail for robes, being suspended by three straps. Besides two large compartments on the inside there are two large and two small patch pockets on the outside. The bag, which is waterproof, measures 24 inches in height and is 18 inches wide. It is manufactured of three different fabrics, patent leather finished duck, melodeon rubber cloth, double texture mackintosh and fabric leather, at \$3, \$3.25, \$3.50 and \$4.25 respectively.

Auto-Comfort Robe.

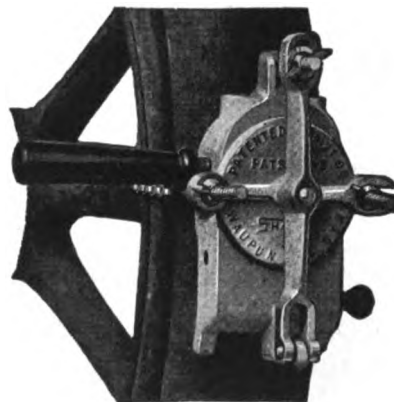
The ordinary lap robe, such as was used in the days of carriage riding, does not meet the needs of motoring. They blow off, slip away from the feet and have to be held in position around the neck for chest protection. The Auto-Comfort Robe Company, Gloversville, N. Y., manufactures a robe for motoring which meets practically all the requirements of an article adapted for that purpose.



Woodworth Trouble Proof Tire.



Atlas Robe Rail Bag.



Shaler Vulcanizing Outfit.

pose. It has pockets at the bottom in which the feet may be placed for the purpose of either keeping them warm or serving to hold the robe down in a wind, and is also fitted with a double overlap, which may be drawn up and fastened about the neck to shut out the wind and cold blasts when motoring in winter or among the mountains in the summer. It is of sufficient width to cover three people. The blanket is made in summer, fall and winter weights at prices ranging from \$10 upward.

Simplex Vacuum Bottles.

The Simplex Vacuum Manufacturing Company, 1729 North Phillip street, Philadelphia, manufactures a large line of vacuum bottles for camping and outing purposes. One of the most popular sizes for touring and motor picnics is No. 406, which has a heavy nickel brass seamless case. It has a capacity of one pint and sells for \$1.50. The same company also makes a large line of luncheon kits and similar paraphernalia, which are described in its catalogue.

Woodworth Trouble Proof Tire.

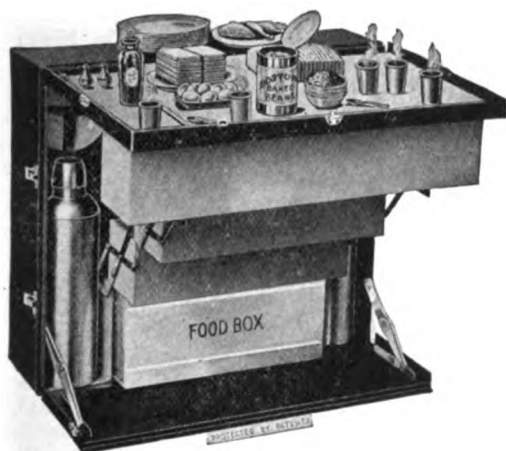
A tire that is guaranteed to be free from punctures for 5000 miles will not only save the user many dollars in the long run, but will also enable him to discharge from his mind much of the worry ordinarily occasioned by tire trouble. The Leather Tire Goods Company, Niagara Falls, N. Y., not only makes this guarantee on the Woodworth trouble proof tire, but agrees to repair the tire free of cost should it become necessary to make good its guarantee. The tire is made up of the best of materials, including combed Sea Island cotton, a durable rubber compound and a non-puncturable strip of chrome leather.

Mossberg Socket Wrench Set.

The Frank Mossberg Company, Attleboro, Mass., is the manufacturer of a most complete set of socket wrenches. The Mossberg socket wrench set No. 14 consists of 37 guaranteed sockets, both hexagon and square, five set wrenches which have 10 openings, a universal joint for reaching nuts at all angles, three sizes of screw driver bits, a pipe wrench, long extension tube, cotter pin tool, reversible ratchet handle, offset handle and a take down T handle. The price of the set in a wooden case is \$12.



At Left: Auto-Comfort Tourists' Robe; at Centre: Simplex Vacuum Bottle; at Right: Mossberg Socket Wrench Set. No. 14.



Knickerbocker Pullman Diner.

Shaler Vulcanizing Outfit.

One of the neatest and most efficient portable tire vulcanizers on the market is manufactured by the Shaler Company, 250 Fourth street, Waupin, Wis. This vulcanizer, which sells for \$3.50 complete, can be applied to the shoe without removing from the rim or wheel. It holds just enough fuel, either gasoline or alcohol, to properly vulcanize, and makes over or under curing impossible. The blaze is not exposed, eliminating the danger of setting anything afire or damaging the finish of the car. Each vulcanizer is packed in a strong telescoping box that will fit into the tool box.

Sterno Canned Heat.

Sterno Canned Heat is a paste, like cold cream, which lights readily and can be extinguished and relit until the supply in the container has been exhausted. Being smokeless, odorless, non-explosive and non-spillable, it makes an ideal cooking fire while camping out. The manufacturer, S. Sterno & Co., John and Gold streets, Brooklyn, N. Y., also make a number of cooking utensils that are specially adapted for use with the Sterno fire. Sterno Canned Heat sells for 10 cents a can and comes in boxes of six and in cases of a dozen cans.

Pullman Diner.

The Knickerbocker Case Company, Fulton and Clinton streets, Chicago, manufacture a dining set called the Pullman Diner. It combines all the necessary articles to serve a meal in an enticing fashion and yet when closed up occupies but little space in the car. It also can be set up in the tonneau and opened for serving meals, the occupants remaining in their seats. Unfolded it presents a dining table, removable metal food box, and contains six white enameled plates, cups and saucers, six nickel silver knives, forks and spoons, six cloth napkins and salt and pepper shakers. The case has an artificial leathering and is reinforced with iron flanges. The "Made Right" No. 3 sells for \$25 without the thermos bottles.

Auto Hot Plate.

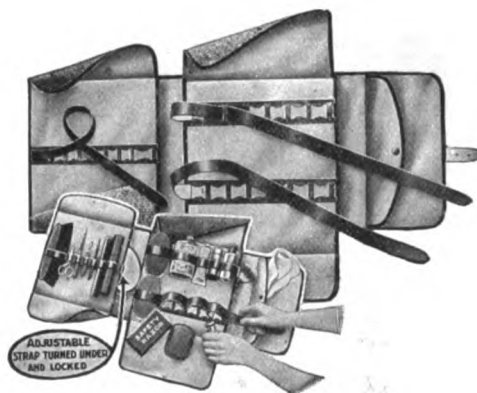
The Prest-O-Lite auto hot plate, the fuel for which is Prest-O-Lite gas, is designed primarily for those motorists who appreciate hot coffee, or similar food, as a part of their roadside luncheons. It is ideally compact, convenient and economical, and weighs only six pounds com-



Brugan Economy Valve.



Puffer-Hubbard Lunch Table.



Fitall Adjustable Toilet Kit.



Sterno Canned Heat.



Comfo-Lux Back Rest.

plete, measures eight by eight by five inches and can be easily carried under the seat. The Prest-O-Lite Company, Inc., Indianapolis, Ind., is the manufacturer.

For use as a camp light a two-way valve union and a Prest-O-Lite stem and burner may be attached to the cylinder. By this means the lights or the hot plate may be used either separately or simultaneously. The hot plate without a gas tank sells for \$4.50 and the two-way union and stem burner at 75 cents and 55 cents extra respectively.

Puffer-Hubbard Lunch Table.

The Puffer-Hubbard outing lunch table affords a neat, complete table two feet wide and four feet long when unfolded. It folds into a space of $1\frac{1}{2} \times 10 \times 24$ inches when not in use. With this device it is possible to have a level table regardless of conditions. If the ground is uneven, one or more of the legs may be sunk a sufficient depth in the ground to compensate for the alignment. It is manufactured by the Puffer-Hubbard Manufacturing Company, Minneapolis, Minn., and sells at \$5. The metal parts are of smooth steel and rust proofed in white finish, while the top is of three-ply birch veneer and nicely finished.

Brugan Economy Valve.

With gasoline at its present high price, every motorist should obtain all possible energy from his fuel. To obtain greater efficiency from automobile engines, it is imperative that the gasoline be well mixed with air. Adhering to this principle, the Brugan economy valve when installed in the intake manifold, automatically admits air as needed, which tends to break up the gasoline particles that have come through the carburetor, resulting in a lean, powerful and free burning mixture.

The valve which is manufactured by the Brugan Company, Bangor, Me., sells for \$4. It is designed to be attached to any car by drilling a hole in the intake manifold near the carburetor and tapping for a quarter inch standard pipe thread. It is shipped adjusted to average conditions, but may be more finely readjusted to suit individual cases.

Fitall Adjustable Toilet Kit.

The Fitall kit is instantly and easily adjustable to all types and sizes of toilet articles. This is accomplished by ad-

justable straps. A loop can be skipped for large articles or each single loop may be utilized for small fittings as desired. When all articles are in place the straps can be drawn tight through the last loop and then through the loop underneath, as indicated by the arrow in the illustration. The straps lock automatically at any place. Elseman, Kaiser & Co., 23-31 South Franklin street, Chicago, Ill., manufactures this useful article. Fitall kits have three large extra pockets, which are convenient for wash cloth, sponge or other articles. The kits are made in different sizes and in a variety of attractive styles of water proof fabrics and flexible leathers.

Comfo-Lux Back Rest.

The driver of an automobile, no matter how well the seat may be upholstered, feels more or less fatigued at the end of a long run. The Comfo-Lux Back Rest, made by Rudolph Claus, Ottawa, Ill., greatly relieves this fatigue. It can also be used by occupants of the other seats. It is of concave form, $4\frac{1}{2}$ inches thick at the bottom, and tapering to a depth of $\frac{1}{2}$ inch at the top. It is nicely upholstered in fabrikoid. The price is \$3.

Old Roman Solder.

Old Roman Solder, the product of the Sole Manufacturing Company, 148 Chambers street, New York City, is a substance for repairing leaks in radiators, tanks, carburetors, pump connections and the like, without the aid of the heat or acid required in the usual soldering processes. On exposure to air or contact with water the substance hardens almost instantly. It is sold in neat collapsible tubes at a moderate price.

Icy-Hot Motor Restaurant.

The Icy-Hot Bottle Company, Cincinnati, O., offers new styles of motor restaurants for tourists at very moderate prices, for parties of four and six persons. The cases are of basswood, with a patent leather like finish, and the interiors are finished in "Baskit." The restaurants include plates, knives, forks, spoons, napkins, cups, jelly jar and a large lunch box, while in the lower half are three divisions for vacuum bottles or fruit jars. The case measures 12 by $15\frac{1}{2}$ by $9\frac{1}{4}$ inches.

Martin Water Bucket.

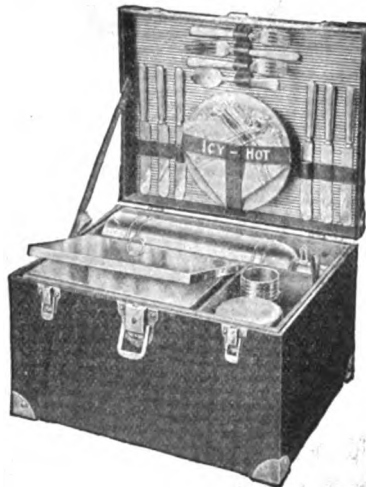
One of the best all-round folding water buckets on the market today is made by the Martin Manufacturing Company, Lancaster, O. The maker describes it as being made of heavy and first grade imitation leather, not cheap oil cloth, and consequently far superior as to durability and general service. The bucket is so shaped that water can be poured into the radiator without spilling.

Legalite Lens.

Legalite lens is of a special non-glare type, made by the Legalite Corporation, Dept. 136, 120 Boylston street, Boston, Mass. The lens consists of a combination of three distinct prisms arranged horizontally, throwing the beam of light downward and across the road and never more than 42 inches above the ground. The maker asserts that the lens gives 26 per cent. more light than the ordinary type and without glare.



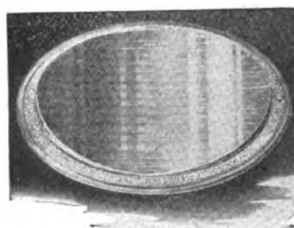
At Left: Old Roman Solder; Above: C-Clear.



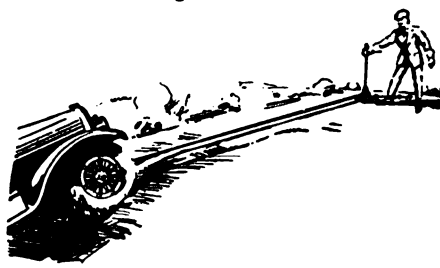
Icy-Hot Motor Restaurant.



Martin Folding Water Bucket.



Legalite Lens.



Never-Stuck Auto Puller.

Never-Stuck Auto Puller.

The principle upon which the Never-Stuck Auto Puller is based is well depicted in the accompanying illustration, as is its purpose. The maker, the Montgomery Ward & Co., New York and Chicago, declares that it will pull a car out of any hole or rut, and that it is adaptable to other purposes as well. The complete outfit is priced at \$6.50.

C-Clear.

It is claimed by the manufacturer of C-Clear, the Sole Manufacturing Company, 148 Chambers street, New York City, that the substance when rubbed over the windshield glass will prevent water or snow from adhering and thus make vision unobstructed even in a violent storm. C-Clear is a paste and is easily handled and carried. The price is 25 cents per can.

Little Wonder Vaporizing Valve.

The Little Wonder Vaporizing Valve, made by the Burgess Specialty Company, 98 Pond street, Providence, R. I., is described by the manufacturer as a device which reduces consumption of gasoline and increases the power of the engine. The claims have been proven by A. A. tests, they showing 37.5 per cent. gasoline saved on a four-cylinder motor, 41.8 on a six-cylinder, and 42.2 on an eight. Increase in power ranged from 18 to 34 per cent. The device is priced at \$4.

Eagle Oil Chart.

The Eagle Oil and Supply Company, 44 India street, Boston, Mass., manufacturer of a complete line of Eagleline oils for every type of motor, is distributing free of charge to inquirers a unique lubrication chart. The chart has been worked out upon scientific principles and years of experience, it basing the need of oil upon the condition of the motor and wearing parts rather than upon climatic conditions.

Wonder-Mist.

Wonder-Mist is a fluid which cleans, polishes and preserves the finish of automobiles. It is made by the Wonder-Mist Company, 14 Federal street, Boston, Mass., and is sprayed onto the machine with a device which is sold with the fluid. The maker asserts that garagemen and owners find it much cheaper and more satisfactory to use than soap and water, a statement that is borne out by the fact that thousands of motorists are using it.

Motor Specialties.

The Motor Specialties Company, Waltham, Mass., is offering three devices that have proven their efficiency in actual service on thousands of cars. One is the Mosco wheel puller, which is of the loose plunger type and designed for Ford, Overland, Buick, Maxwell, Saxon and Chevrolet cars. The second is the Mosco valve grinder, which operates on a new principle and absolutely insures rapid and accurate work. It is priced at \$1.50 and is thoroughly guaranteed. The third product is the new model Bemus Timer, of ball contact type, and for Ford cars. This device has been greatly refined over last year's model. It has top wire connections, offset balls, extra long, non-wearing roller, reinforced arm, and is priced at \$2.50.

RALPH DE PALMA WINS TWO 150-MILE RACES.

Ralph De Palma added fresh laurels to his string of victories during the latter part of June and the first of the present month, winning on June 28 at Des Moines, Ia., and the main event in the Mid-Continent races at the Twin City Speedway on July 4.

At Des Moines he averaged in a Mercedes 92.66 miles per hour for 150 miles, his time being 1:36:36.23, which is nearly six miles per hour faster than the winner's time over the same course last year. His victory was exceptional, as it was devoid of the usual ill luck that seems to follow this racing star. He was obliged to make the pits but once, driving in to change a front right tire, losing about half a minute. The Mercedes led all the cars throughout the race except Rickenbacher, in a Maxwell, who gave him a close contest up to the 140th mile, when the latter through tire trouble not only lost every chance of winning, but also second place, which was taken by Henderson in another Maxwell.

Henderson finished one minute and 48 seconds behind De Palma, his elapsed time being 1:38:13.72. Rickenbacher, despite the series of tire troubles that set him back, came across the tape third in 1:39:18.72. The others finished in the following order: Dave Lewis, Crawford; Joe Cooper, Stutz; Ralph Mulford, Hudson Super-Six; Galvin, Sunbeam; Chandler, Stutz.

Of the \$10,000 prize money De Palma won \$3500, and Henderson and Rickenbacher \$1500 each, the remainder going to other contestants. De Palma's winnings included \$300, the first prize of the main event, and \$500, second money in the 50-mile event.

There were two accidents, as a result of which the Duesenbergs were put out of the running. Wilbur D'Alene was forced out when his right rear wheel collapsed, while his team mate, Tom Milton, in attempting to avoid a collision with the injured car turned to the apron, where he lost control and the car turned turtle. Eddie O'Donnell, who also entered a Duesenberg, dropped out in the 86th lap with a broken steering gear.

The 50-mile race which followed the main event was won by Rickenbacher, who made the distance in 31 minutes and 9.17 seconds, an average of 96 miles an hour. The contest was faster and far more exciting than the 150-mile race, De Palma finishing only nine seconds behind the winner. Joe Cooper, in his Stutz, worried the leaders throughout the contest and made the triangular battle very spectacular. Lewis finished fourth, Henderson fifth and Galvin sixth.

Mid-Continent Races.

The 150-mile event in the Mid-Continent races at the Twin City Speedway, which was won by De Palma, was a very tame affair compared with the race in which he took the honors during the week previous at Des Moines. He took the lead early in the race and held it until the finish, with an elapsed time of 1:38:49.20, or an average speed of 90.8

Victor In Des Moines Speedway Classic and Twin City Contest.

miles an hour. His only real opponent throughout the contest was Aitken, in a Peugeot, who finished second in 1:40:14.05.

During the early part of the race Christiaens in a Sunbeam enlivened the contest with sustained bursts of speed, keeping the lead for 20 miles at one time. He finished third, however. Milton and O'Donnell, in Duesenbergs, finished fourth and fifth respectively; Sorenson, in a Marse, sixth; Muller, in a special make, seventh.

RACE FOR MOTORCYCLE HONORS.

The races for the amateur motorcycle championships of the United States will be held at Providence, R. I., July 27 and 28, during the convention of the Federation of American Motorcyclists, to be held in that city.

The winner of the title also takes the Bosch trophy, which is of silver and almost two feet high. The title and cup are awarded under the points system, the riders receiving a certain number of points when they finish first, second or third in the championship events. The trophy cup is awarded by the Bosch Magneto Company of New York.

COMING EVENTS

July.

Race (track), North Yakima, Wash. July 15
Race (track), Omaha, Neb. July 15
Demonstration (farm tractors), Dallas, Tex. July 17-21

August.

Demonstration (farm tractors), Hutchinson, Kan. July 24-28
Demonstration (farm tractors), St. Louis, Mo. July 31-Aug. 4
Race (track), Tacoma, Wash. Aug. 5
Demonstration (farm tractors), Fremont, Neb. Aug. 7-11
Race (track), Kalamazoo. Aug. 11-12
Hill Climb, Pikes Peak. Aug. 11-12
Race (track), Portland, Ore. Aug. 12
Demonstration (farm tractors), Cedar Rapids, Ia. Aug. 14-18
Race (road), Elgin, Ill. Aug. 18-19
Demonstration (farm tractors), Bloomington, Ill. Aug. 21-25
Race (track), Kalamazoo. Aug. 26

September.

Show, Columbus, O. Sept. 2-9
Race (track), Elmira, N. Y. Sept. 4
Race (speedway), Des Moines. Sept. 4
Race (speedway), Indianapolis. Sept. 4
Race (track), Spokane, Wash. Sept. 4-5
Demonstration (farm tractors), Madison, Wis. Sept. 4-8
Show, Milwaukee. Sept. 11-16

Race (speedway), Providence. Sept. 16
Race (track), Trenton, N. J. Sept. 29
Race (speedway), New York, Sheepshead Bay Speedway. Sept. 30

October.

Convention, National Association Automobile Accessory Jobbers, St. Louis. Oct. 2-5
Race (speedway), Omaha, Neb. Oct. 7
Race (speedway), Philadelphia. Oct. 7
Race (speedway), Chicago. Oct. 14
Race (speedway), Indianapolis. Oct. 19
Race (track), Kalamazoo, Mich. Oct. 21

January, 1917.

Show, New York City. Jan. 6-13
Show, Chicago. Jan. 27-Feb. 3

A VALUABLE BOOK.

An exceedingly instructive book is "The Gasoline Automobile," by G. W. Hobbs, B. S., instructor of mechanical engineering in the University Extension Division of the University of Wisconsin, and B. G. Elliott, M. E., associate professor of mechanical engineering in the University of Nebraska, the first edition of which has been published by the McGraw-Hill Book Company, 239 West 39th street, New York City.

The book contains 253 pages, is profusely illustrated and has many charts and diagrams relating to the contents. It is divided into 10 chapters, which consider general construction, engines, power plant groups and transmission systems, lubrication and cooling, fuels and carburetion systems, battery and magneto ignition, starting and lighting systems, automobile troubles and remedies and operation and care.

The book is intended for those who desire practical and substantial knowledge of motor vehicle design and construction as free from technicalities as is possible.

MAXWELL REDUCES 1917 PRICES.

The Maxwell Motor Car Company, Detroit, has announced a reduction of \$60 in the price of the touring car for 1917, and of \$55 for the roadster, the new prices being \$595 and \$580 respectively. No changes in design will be made, following out the policy of the company to standardize its product. There will be five body designs, however, including a streamline five-passenger touring car, a two-passenger roadster, a two-passenger cabriolet, a six-passenger town car and a six-passenger sedan. President Flanders said the price reductions are made possible through increased production and lower manufacturing costs, and expects to turn out 100,000 cars.

President Hackett of the Argo Motor Company has confirmed the statement that a larger four-cylinder model will be added to the Argo line. A formal detailed announcement is expected to be forthcoming by Aug. 1.

SUGGESTIONS FOR THE FORD CAR OWNER.

Method of Reassembling the Clutch and Insuring Its Efficiency of Operation—Testing the Dynamo for Clearance and Production of a Satisfactory Current.

The 51st article dealing with the operation, construction, maintenance, care and repair of the model T Ford chassis is the 12th of the series devoted to adjusting, restoration and repair.

AS THE three drums and three triple gears are assembled as described in the previous installment, they can be handled practically as a unit, and the worker can without difficulty place the assembly with the gears downward on the flywheel, so that the bores of the gears will take the shafts on which they revolve. Assuming that the engine is not in the chassis, in which condition the work can be much easier done and there is small probability that an overhaul would be undertaken with the block remaining in the frame, the better manner of assembling is to first bolt the transmission shaft and the flywheel to the crankshaft flange.

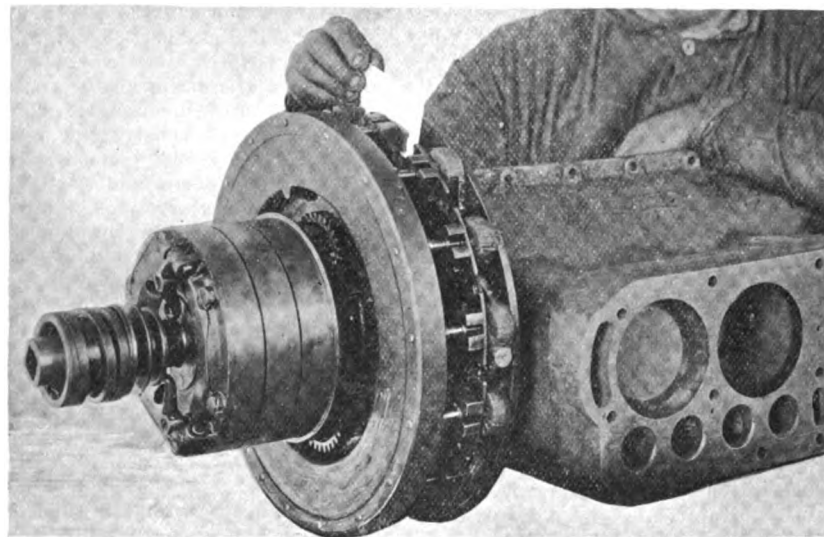
After the dowels of the flywheel have been

In any event the clearance between the engine block and the flywheel flange is small and patience is necessary to put on the nuts, tighten and lock wire them, but the work is practical for any person with the right tools. After the flywheel has been bolted, but before the nuts have been locked, test should be made of the magneto or dynamo. This work can be done after the entire gearset has been assembled, or before, dependent upon the desires of the worker. In making the illustrations the gearset was assembled, as there is considerable weight on the rear end of the crankshaft and there was belief that the condition could be better determined at that time than when the unit was incomplete. The work will be described as it is illustrated, with suggestions for making tests that are necessary to insure the operation of the dynamo.

When the transmission shaft is bolted with the flywheel to the crankshaft flange and the triple gears and the gearset drum are on the shaft and studs there should be no play of the sleeve on the shaft.

Assembling the Clutch Discs.

Continuing the assembly from this point, the key that retains the clutch disc drum should be placed in the keyway of the transmission shaft, and then the clutch disc drum should be driven on and seated and the set screw that prevents longitudinal movement of the drum should be placed and tightened. The next thing is the clutch, which is normally made up of 26 discs, 13



Proving the Clearance of the Dynamo Magnets and the Field Coils with an Ordinary Business Card.

placed in the flywheel flange and the bolts set into the four holes of the flange, the nuts can be put on the bolts and tightened. Care should be taken in this work to have the nuts set as tight as is possible, for there should be no play and there is great strain upon the drums and the entire assembly. Should the flywheel be loose a pounding noise will be caused when the engine is operated and more or less damage will result. The nuts should be carefully lock wired so that they will not loosen later on. Unless this work is well done there is probability that the machine will need partial disassembling to make the correct adjustment, which will be absolutely unnecessary if reasonable care is observed.

large and 13 small, with a distance ring or master disc seated against the flange that carries the brake drum. If these rings have worn through use an additional pair of discs, or even more may be necessary to restore the clutch to efficiency, and such rings as have been heated so that they have been softened—which can be learned from examination—as the worthless rings will be blue instead of bright metal—can be discarded and replaced by others.

Efficient operation of the clutch, as has previously been stated, depends largely upon the condition of the distance ring, which should be about three times the thickness of the other discs. If this ring has been worn by the brake drum

flange and the contacting disc so that it does not have substantial bearing on the clutch disc drum it should be replaced. Speaking generally a new ring is a positive restoration and is preferable to taking chances with a worn member, because an overhaul should be made with the purpose of making as complete restoration as is possible, and not a temporary repair. Should the distance ring not have sufficient seat and drop between the clutch disc drum and the brake flange, the discs cannot be evenly compressed. The clutch will not hold securely and cannot be relied upon, and the discs will wear unevenly and excessively in places. Besides, the clutch will in this condition cause a peculiar pounding sound whenever the engine is driven.

Regular Order for Assembly.

When the distance ring is placed a small disc should be next to it, and then the discs should be alternately large and small until the entire space is filled, the last or outer disc being large. This arrangement is necessary to bring a large disc so that the clutch push ring will bear upon it, this ring also being carried by the clutch disc drum. The three projecting studs of the clutch push ring are outward and the ring should be so placed that when the driving plate is bolted to the brake drum the studs will engage in the holes in the plate and against the three clutch fingers that are mounted on the plate.

One should understand that the order of assembly given will apply equally well when the gearset is assembled on the bench or on the engine, the only difference being that when on the bench the transmission shaft is vertical, and when on the engine the shaft is horizontal. When the gearset is assembled on the bench and the flywheel must be bolted to the crankshaft flange, the very limited space between the crankshaft flange and the engine block, and necessity of supporting the assembly until the nuts are set on the bolts, are conditions that may try the patience of the worker, and these should be avoided.

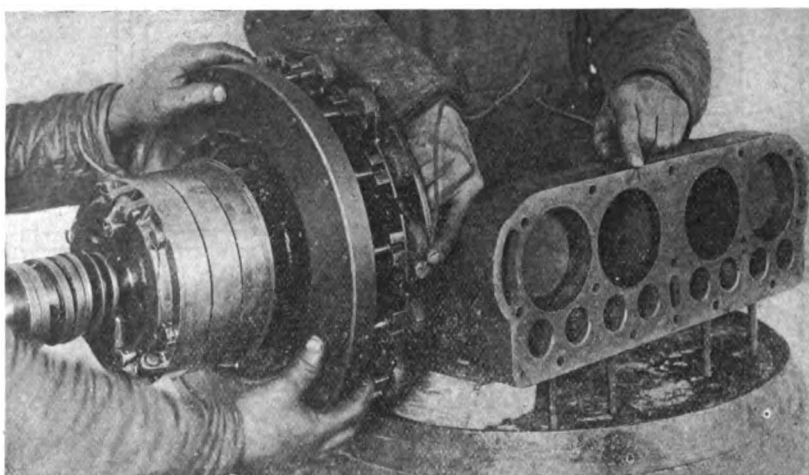
Testing the Gearset Operation.

After the driving plate is bolted to the brake drum the assembly should be tried by turning the three drums successively with the hands, and if the work has been well done the movement should be free, with no play. If the movement is not free then the cause of this condition should be found and the necessary change made in the assembly. While there may have been no reason to remove the other components of the gearset from the driving plate, if this has been done, the reassembling should be as follows: The clutch shift should be placed on the sleeve of the driving

plate so that the small end rests on the ends of the clutch fingers. The clutch spring is then put on which the clutch supports inside of it, so the flange will rest on the upper coil of the spring.

The clutch spring thrust ring is put on with the notched end toward the flywheel and is pressed into place, after which the pin is inserted in the driving plate sleeve through the holes in the sides of the spring support. The tension of the clutch spring can be eased by backing the adjusting screws under the clutch fingers, and when the screws are again seated the spring should be compressed until it is two or $2 \frac{1}{16}$ inches length, care being taken to seat the screws evenly so that there will be the same compression at the three points of clutch finger contact.

The assembly completed, the next work is to see that there is the desired clearance— $\frac{1}{32}$ inch—between the magnet clamps and the coils of the field, which should be precisely the same at all of the 16 points on the flywheel or the field when the engine is being driven or is stationary. This



Testing the Current Production of the Dynamo with a Short Length of Wire Grounded on the Engine Block.

condition can be tested by placing a regular business card between the flywheel and field at each of the coils and turning the flywheels, and by passing the card between the magnet clamps and the coils while the flywheel is motionless. If the clearance is less the strength of the current will be impaired, and restoration may be practical by springing the field coil plate. If this is attempted much care will be necessary, because the relation of the other magnets and coils should not be changed, and greater clearance may be only necessary at one point. When the condition is satisfactory the dynamo should be tested by placing one end of a short length of wire on the contact point of the field, and the other end on the engine block and turning the flywheel. A spark will be generated at the end contacting with the block and the size of this spark is the basis for determining whether the current generated will be sufficient. This test is illustrated.

(To Be Continued.)

MOTOR STARTING AND CAR LIGHTING.

Thorough Knowledge of Equipment Absolutely Essential---Symbols Representing Construction Details in Wiring Diagrams---Three Systems in General Use.

WHATEVER the electrical systems of the car may be, it will be in a broad sense efficient in ratio to the care that is given. No car owner or driver should assume that he can neglect or misuse its equipment without sacrificing pleasure, convenience and comfort, and experiencing some of the annoyances that come with failures, to say nothing of the expense that is equally certain to follow.

The manufacturer of any car that is equipped

be superfluous. Other books are not so complete or as instructive, there seemingly being the assumption that the owners can obtain whatever data is necessary from other sources.

Owner Has His Responsibility.

For instance, without any other source of lighting than electricity the owner has a considerable responsibility to meet in the event of failure. There is the danger as well as the necessity of complying with the law, and absence of

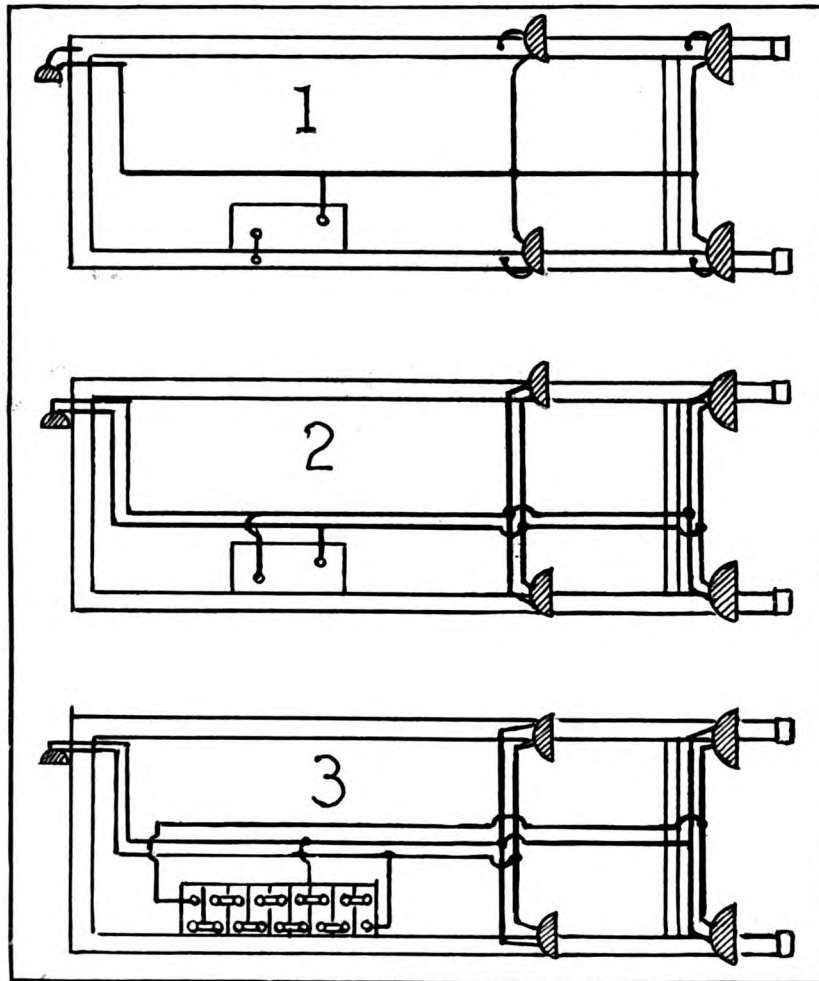
lights is not excusable by a court. Should there be a defect in the starting system a machine can be started by cranking or by coasting or by pushing, but if the lights are not operative a very serious situation is met with. Obviously the average owner cannot expect to have knowledge to deal with every condition that may arise, but neither can he rely upon having available assistance whenever there is an emergency. Without question the best insurance he can have is his own knowledge. As each system will vary somewhat—even with the same make and type as found in two different cars, the best safeguard is to study his own equipment and understand it as thoroughly as is possible.

Of course the first essential is to read whatever information may be furnished by the builder of the car, and this had best be done beside the car, following each unit and auxiliary or accessory and identifying it from the written description. This will inform the owner of the use and location of each, and he will then more clearly understand the instructions

given with reference to care and maintenance. There are, of course, general principles of electric design and construction and operation that can be applied to all systems, and these must be understood first of all.

Principal Units Easily Identified.

The principal units of the system are easily identified, and in most instances they are marked. In some of the wiring diagrams the auxiliaries



The Three General Types of Wiring of Lighting Systems: 1, the Single-Wire or Grounded Return; 2, the Two-Wire or Direct Return; 3, the Three-Wire Six and 12-Volt System.

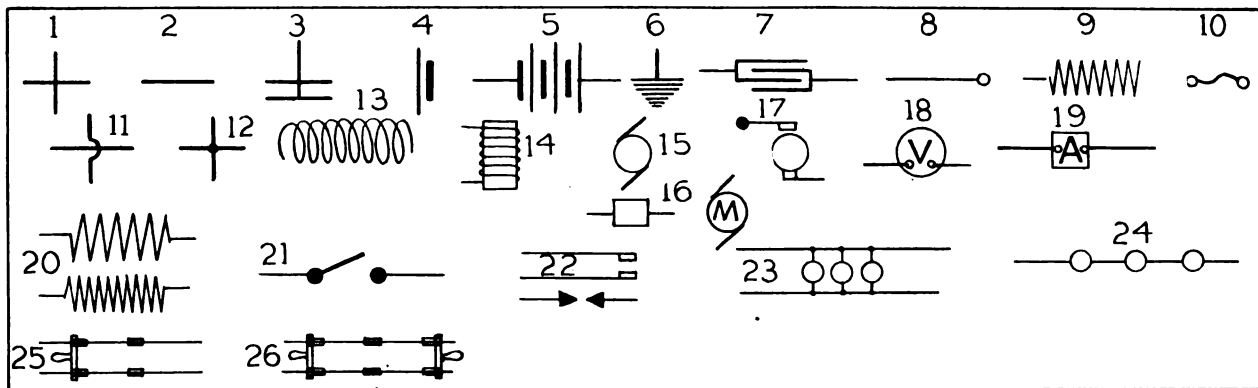
for electric lighting and starting usually provides a book of instructions for operating and maintaining the system or systems. Some of these booklets are very carefully prepared, the text being written so clearly that every detail may be understood, and are well illustrated. Such information is evidently provided with a keen realization of its value to the owner, and, no matter how minutely the subject is reviewed, it will not

and accessories are indicated by outline sketches so that they will be known by the shapes, but in others they are not so clearly represented. Very few of the instruction books give definitions of the symbols used in the wiring diagrams, and for the information of the readers of these articles a series of indications is given that may appear wholly or in part on any diagram. The reader should study these sufficiently so that any diagrams can be quickly read and understood.

In studying wiring diagrams the owner must first know the character of the system he has to deal with, and he will find that there are three forms of lighting circuits in use in automobile practise, which are known as the one-wire or grounded return, the two-wire or direct return, and the three-wire systems. Of these the first and second are common, while the three-wire equipment is seldom used. The starting circuit may be either one or two-wire. That the lighting circuits may be the better understood a series of diagrams is shown which illustrates the principles of each of the three.

readers may assume there ought to be but one wire in a single-wire system, and might become confused were they to find two leads from a lamp. The negative side of the battery must, in any case, be connected with the car frame. For the purpose of identification the short wire from a fitting will be the negative or frame connection with a single wire system. With rare exceptions the connections on the positive side of the circuit will be fitted with fuses—between the battery and the lamps or fitting—so that in the event of the wire becoming grounded the fuse will melt and no material damage will be done the wiring, or the battery. There is no control of a grounded current and the discharge from the battery might be at a very heavy rate. Rapid discharge would in any event result in unnecessary loss of current and necessitate charging of the battery.

The two-wire system requires a complete circuit of wiring from the positive terminal of the battery to the negative terminal, with a connection from the lamp of fitting to each side. There are no connections between the circuit and the



Different Symbols Used in Wiring Diagrams and Charts: 1, Positive Terminal; 2, Negative Terminal; 3, Positive or Negative Terminal; 4, Battery Cell; 5, Battery; 6, Ground; 7, Condenser; 8, Wire or Cable Terminal; 9, Coil That Is Not Clearly Defined; 10, Fuse; 11, Wires Crossed, but Not Connected; 12, Wires Connected; 13, Coil or Solenoid; 14, Electromagnet; 15, Direct Current Generator; 16, Motor; 17, Motor Commutator and Brushes and Lifting Brush Switch; 18, Voltmeter; 19, Ammeter; 20, Primary and Secondary Windings of Transformer Coil; 21, Lighting Switch; 22, Contact Points; 23, Lamps in Multiple; 24, Lamps in Series; 25, Single-Throw Switch; 26, Double-Throw Switch.

Considering the first, or one-wire system, one will understand that a wire is carried from the positive terminal of the battery to each lamp or auxiliary, and from each part so connected that the current is carried back to the negative terminal of the battery through the chassis frame. Generally the parts are connected with the frame through short wires attached to the negative sides, although in some instances the ground may be made directly through the frame or base of the fitting. Much depends upon the construction of the car. A dash lamp, for instance, will probably have two wire connections—the one with the main positive lead from the battery and the other with the frame—because of the degree of separation of the lamp and the frame, which would preclude a direct ground.

If the lamp were located on the frame it would not be especially serviceable for illumination. This qualification is made because some

chassis frame. As a rule fuses are not used with the two-wire system, though they may be fitted in some circumstances.

The three-wire system requires a complete wiring circuit like the two-wire system, but a larger battery is used. This battery is divided into two sections and the negative terminals of these sections are joined or coupled. There are two positive wires from the positive terminals of the two sections of the battery. Connecting one of the positive wires with the wire coupled to the negative terminals will give one voltage, and connecting the other positive wire to the wire coupled to the negative terminals (which is known as the neutral wire), will give another voltage. The neutral wire may be grounded on the car frame and two wires, each having a different voltage, may be carried to the lamps or instruments.

(To Be Continued.)



ATTACHING TOW LINES.

Attaching a manila rope sling to a rear axle for the purpose of towing with a steel tow line would seem to admit of a number of different ways in which to fasten the sling. According to authorities, however, there is only one correct method if one is to obtain the maximum of service from the sling, and this is shown at C in Fig. 199. Unless the rope is properly arranged there will be a tendency to rapid wear. Two incorrect attachments are shown at A and B.

TESTING STEEL AND IRON.

Nitric acid will determine whether an article be made of steel or iron. When placed on steel, it will produce a black spot; the darker the spot, the harder the steel. If the acid be placed on iron, the surface remains bright. Good steel in its soft state has a curved fracture and a uniform gray lustre. In its hard state it is a dull, silvery uniform white. Cracks, threads or sparkling particles denote poor quality. Good steel will not withstand a white heat without falling to pieces. It will also crumble under the hammer at a bright, red heat, while at a mild red heat it may be drawn out to a fine point.

DETACHABLE TOPS.

Owners of open body trucks can at but slight expense make or have made a detachable top which will entirely enclose

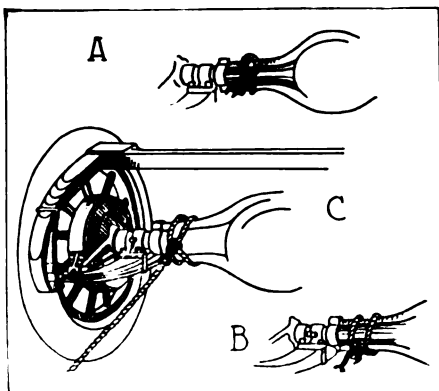


Fig. 199—Attaching Tow Lines.

the carrying space in stormy weather. The arrangement is shown in Fig. 200. The wooden frame work resembles the appearance of a prairie schooner. Three cross staves are used. To form the wood to the shape shown at A in illustration, it is necessary that it should be steamed in a large boiler. The three staves are maintained in an upright position and equidistant by two parallel strips of wood. Small bolts fastened by lock nuts and thumb screws connect the parallel pieces to the staves, as shown at B, the ends of which are shaped to fit small brackets attached to the sides of the car. The method of attaching the frame work to the car is shown at C. Any trimmer or awning maker can make a water proof cover to fit over the frame work. Hooks should be attached to the side of the body as shown at D for tying down the cover.

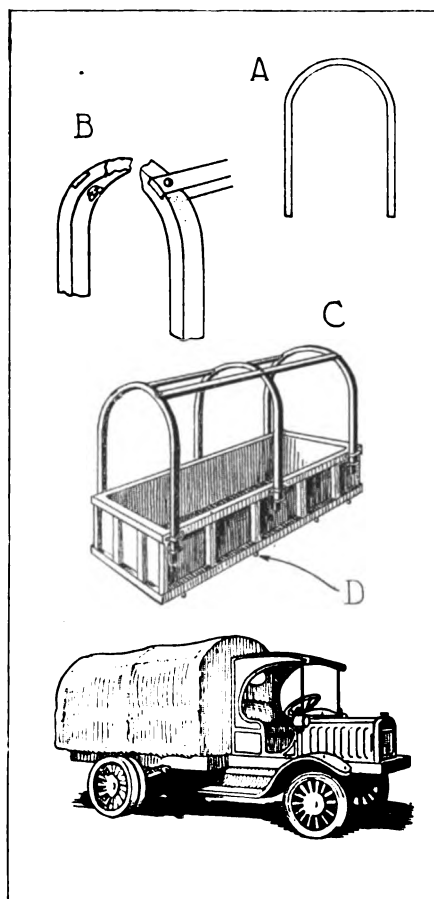


Fig. 200 Detachable Tops.

PISTON RING COMPRESSOR.

Fig. 201 illustrates an easily made tool for compressing the piston rings so that the piston can be inserted into the cylinder. It consists of a strip of $\frac{3}{32}$ inch sheet tin or zinc of about 15 inches in length and $2\frac{1}{2}$ inches in width. About an inch from the ends the metal should be bent at right angles as at A. Next bend the strip in a perfect circular shape so that the two flat ends register. Drill a small hole through the ends and insert a small bolt and thumb nut. The operation is simple. The compressor is tightened around the rings and the piston pressed into the cylinder. The compressor contacts with the edge of the cylinder, thus allowing the compressed rings to be pushed out of the tool and into the cylinder. The complete assembly is shown at B.

TESTING DRY CELLS.

The usual method of testing the efficiency of a dry cell is to place an ammeter in the circuit. Should one of these instruments not be at hand a rough estimate of the condition of the cell can be obtained by attaching a wire to the zinc or shell terminal of the cell and then touching the carbon element lightly with the free end of the lead. If a small puff of smoke arises on contact, it is safe to assume that the cell is in good condition. If the contact produces only a black ring on the surface of the electrode, it is an indication that the cell is nearly exhausted.

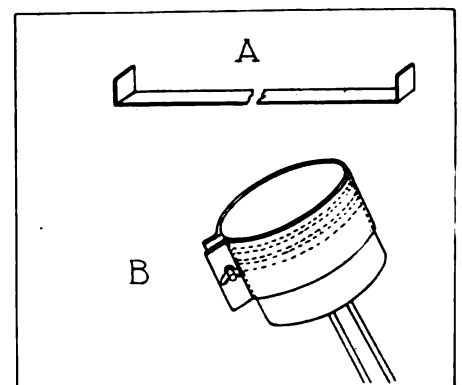


Fig. 201—Piston Ring Compressor.



*West Michigan Pike, Petoskey, Mich.
Treated with "Tarvia-B" August, 1915*

A Tarvia County—

WE sent our Mr. Clark to see the Emmett County Highway Commission, to tell them about Tarvia.

There were many miles of macadam roads in Emmett County which were being churned up into dust by automobiles as fast as they were built. Repair work was incessant and expensive.

Our Mr. Clark said, "Paint your roads with 'Tarvia-B', applied rapidly and cheaply from a modified sprinkling cart, and covered with a little sand or stone screening. The Tarvia will act as a tough binder cementing the surface together.

"That tough and slightly-plastic surface thus formed will be automobile-proof. There will be no dust, no mud and very little wear. The coating can be renewed at small expense and the saving

on maintenance will more than pay for the Tarvia. The use of Tarvia won't increase your road expenses—it will reduce them and give you better roads besides."

So Emmett County bought a tank car of "Tarvia-B", and tried it on the above road.

October 1, 1915, we received this letter:

I wish to say that the tank car of "Tarvia-B" purchased through your man, Clark, is doing everything and more for our roads than he claimed. The Board of County Road Commissioners are trying to arrange to use it on all of our improved county roads in Emmett County next year.

Charles W. Lempke,
Emmett County Highway Commissioner

On March 23, 1916, the Emmett County Commissioners signed an order for 50,000 gallons of "Tarvia-B" to be used on their macadam roads this year.

There is a grade of Tarvia and a Tarvia process for every macadam road problem.

Booklets free on request. Address our nearest office.

Special Service Department

This company has a corps of trained engineers and chemists who have given years of study to modern road problems.

The advice of these men may be had for the

asking by any one interested.

If you will write to the nearest office regarding road problems and conditions in your vicinity, the matter will have prompt attention.

The *Barnett* Company

New York Chicago Philadelphia Boston St. Louis Cleveland Cincinnati Pittsburgh
Detroit Birmingham Kansas City Minneapolis Nashville Salt Lake City Seattle Peoria
THE PATERSON MANUFACTURING COMPANY, Limited: Montreal Toronto Winnipeg
Vancouver St. John, N. B. Halifax N. S. Sydney, N. S.



This Is The Plug



**Have You This
plug On Your Car?**

**Sold
Everywhere**



DETERMINING FIRING ORDER OF MOTOR.

(R. J. B., Davenport, Ia.)

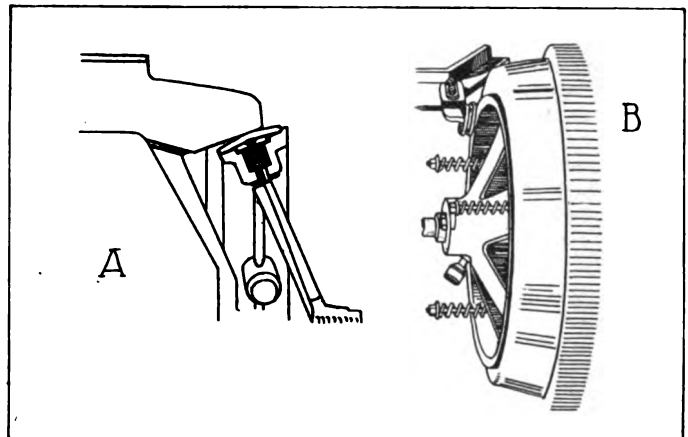
How can I tell whether the firing order of a motor is 1-3-4-2 or 1-2-4-3?

There are several methods, one of the simplest being to watch the opening of the valves, either the exhaust or intake. Open the relief cocks on the engine head and slowly turn the motor over by hand until the intake valve of the first cylinder opens. If the next intake valve to open is in the second cylinder, it can be taken for granted that the firing order is 1-2-4-3. If, however, the next intake valve to open after the one in the first cylinder is that in the third cylinder, the firing order is 1-3-4-2. The opening of valves can be determined by the engaging of the valve stems by the push rods.

WELDING STEERING KNUCKLE.

(H. L. T., Brattleboro, Vt.)

Through accident the steering knuckle on my 1914 ——— runabout was broken. The local agent advises that I must re-



Construction of Overland Clutch.

place this with a new one. Cannot this part be welded?

You should have no trouble having this part welded by the oxy-acetylene process. The workman could build up or reinforce the uniting point and there would be no danger of a break appearing again at the same place. Would suggest that you allow an experienced welder to examine the part; it may be necessary to test it for strains. If the repair is advised, it can be effected in very little time and the cost is trifling.

UNIQUE CLUTCH CONSTRUCTION.

(H. B., Springfield, Mass.)

I happened to be waiting in a repair shop the other day, waiting for my car to be repaired and I was much interested in the construction of the male member of a clutch which I believe was taken from an Overland car. There appeared to be six raised spots on the leather. What is the reason for this?



SCRIPPS-BOOTH

cars have established a new field for luxurious light roadsters. You may judge their value by their standard of ownership.

Roadster \$825.

Coupe \$1450.

CARRY THESE TOOLS IN YOUR CAR

THE MOSCO VALVE GRINDER

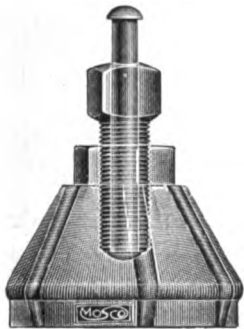


This tool differs radically from others in many respects, but mainly in the fact that it can safely be used by those unskilled or inexperienced in valve grinding. It is really more of a machine than a hand tool, and it renders valve grinding an ACCURATE MECHANICAL OPERATION rather than a guess-work hand job. The operating handle is attached to a chain coiled on a pulley, carrying the tool chuck. The operator pulls the handle, rotating the

tool and the valve; a spring on the chain pulley pulls in the opposite direction, automatically reversing the rotation of the valve. Much greater rapidity can be obtained with the MOSCO GRINDER than with the ordinary tool, resulting in a very superior finish on the seats. Made of the best materials—thoroughly guaranteed. At the price at which it is listed this grinder should be in every tool kit. In ordering state make and year of car or motor.

Price \$1.50 Each

WHEEL PULLERS



(Loose Plunger Type)

For Ford, Overland, Buick, Maxwell, Saxon and Chevrolet Cars.

Every practical man knows that the only way to start a wheel which is "frozen" to the axle is to drive back the axle while pulling the wheel. Two men are required by the old method—the ordinary wheel-puller will never take off a stuck wheel—one man can do it easily with the MOSCO pullers. They have loose plungers extending through the screws—and bearing on the end of the axle. A blow with the hammer on the plunger, a turn of the screw, another drive with the hammer, and the wheel is off—no matter how long it has been on or how fast it is stuck. **Very moderate in price.**

Patented { Mar. 24, 1914
Dec. 15, 1914

**New
Catalogue
Ready**



**Send
For It
Today**

SPECIALTIES

BEMUS BALL CONTACT TIMER

FORD CAR TYPE

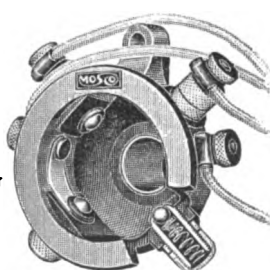
1916 MODEL

We now offer a new model of the Timer which in 1915 met with such phenomenal success. The original construction is retained, but a number of improvements and new features have been adopted which will further advance an acknowledged supremacy.

TOP WIRE CONNECTIONS, OFF-SET BALLS, EXTRA LONG, NON-WEARING ROLLER, REINFORCED ARM.



TIMER SHAFT
EXTENSION



PATENTED

Price \$2.50

MOTOR SPECIALTIES COMPANY
WALTHAM MANUFACTURERS MASSACHUSETTS

Meet Your Motor Half Way!

Any good motor will give you what you want if you give it what it needs.

Not one of its needs is more vitally important than a sure, dependable, red-hot spark---the kind that guarantees complete, rapid combustion---the kind the motor always gets, at any speed, from the

EISEMANN

MAGNETO

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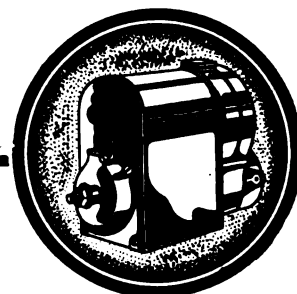
EISEMANN MAGNETOS are made in a range of types and sizes to meet every requirement of gas or gasoline engines.

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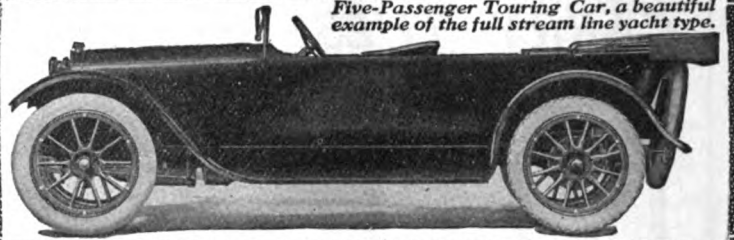
32-33rd Street, Brooklyn, N. Y.

Indianapolis, Ind., 415-417 N. Capitol Ave.
Detroit, Mich., 802 Woodward Ave.



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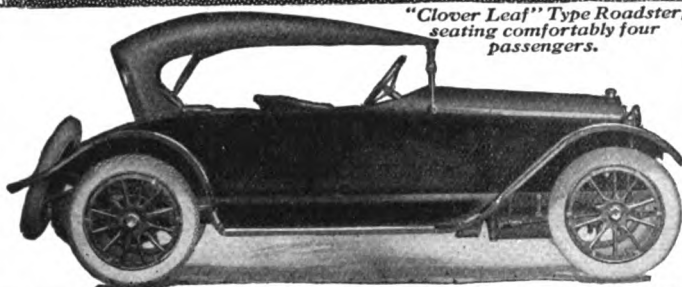
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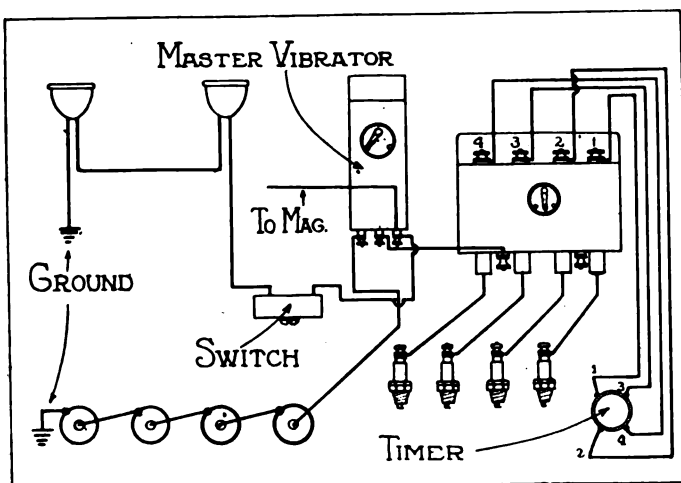
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Paine-Krogman Company
910 Commonwealth Ave.,
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The Car For The Many

Built To Serve Not Merely To Sell

The reason for the raised spots is that there are six small studs under the clutch facing. The principle involved in this construction is that when clutch is gradually engaged, these raised places are the first to contact with the female member of the clutch and provides a gradual increasing contact until the springs are fully depressed and the entire surface is engaged. This prevents harsh gripping or jerking of the clutch.



Wiring Diagram of Ford Car.

Another feature of the Overland clutch is the leather faced brake shown in the accompanying illustration. When the clutch is released the male member has a tendency to continue spinning, due to the momentum. With this construction the edge of the male member touches the small leather faced brake, slows down the clutch and allows a gear change to be made in silence.

(When Writing to Advertisers, Please Mention The Automobile Journal.)

WIRING THE FORD CAR.

(J. Q., Chepachet, R. I.)

I recently purchased a second-hand Ford touring car that is equipped with gas headlights. Can you give me a wiring diagram for doing this work? I am also contemplating installing a master vibrator and using dry cells for starting. Any enlightenment for doing this work will be greatly appreciated.

It is advisable to first install the master vibrator before attempting to wire electric lights. After attaching the vibrator to the dash of the car, the first operation is to short circuit the regular coil. This can be done by screwing down the adjusting screw of the vibrators. A wire is then used to connect either the battery or magneto terminal of the large coil with the centre terminal of the master vibrator. The cable attached to the magneto terminal is then secured to the right hand binding post of the master vibrator as shown in the illustration. The dry cells should then be connected in series and the negative terminal grounded, while the positive terminal should be connected by cable to the left hand terminal of the vibrator. If the centre terminal of the vibrator is connected with the battery terminal of the large coil, the switch on the latter should be maintained in the battery position. If the connection is made to the magneto side of the coil the switch should, of course, be kept in the magneto position.

The next operation is to install a lighting switch on the dash or other convenient position. The illustration clearly shows the method of wiring the lights. This is known as series wiring.

HORSEPOWER.

(B. T. R., Webster, Mass.)

What is the meaning of the term horsepower as used in motor ratings?

One horsepower is the force required to raise a weight of 33,000 pounds one foot in one minute, or a weight of 550 pounds one foot in one second. The terms are used inter-



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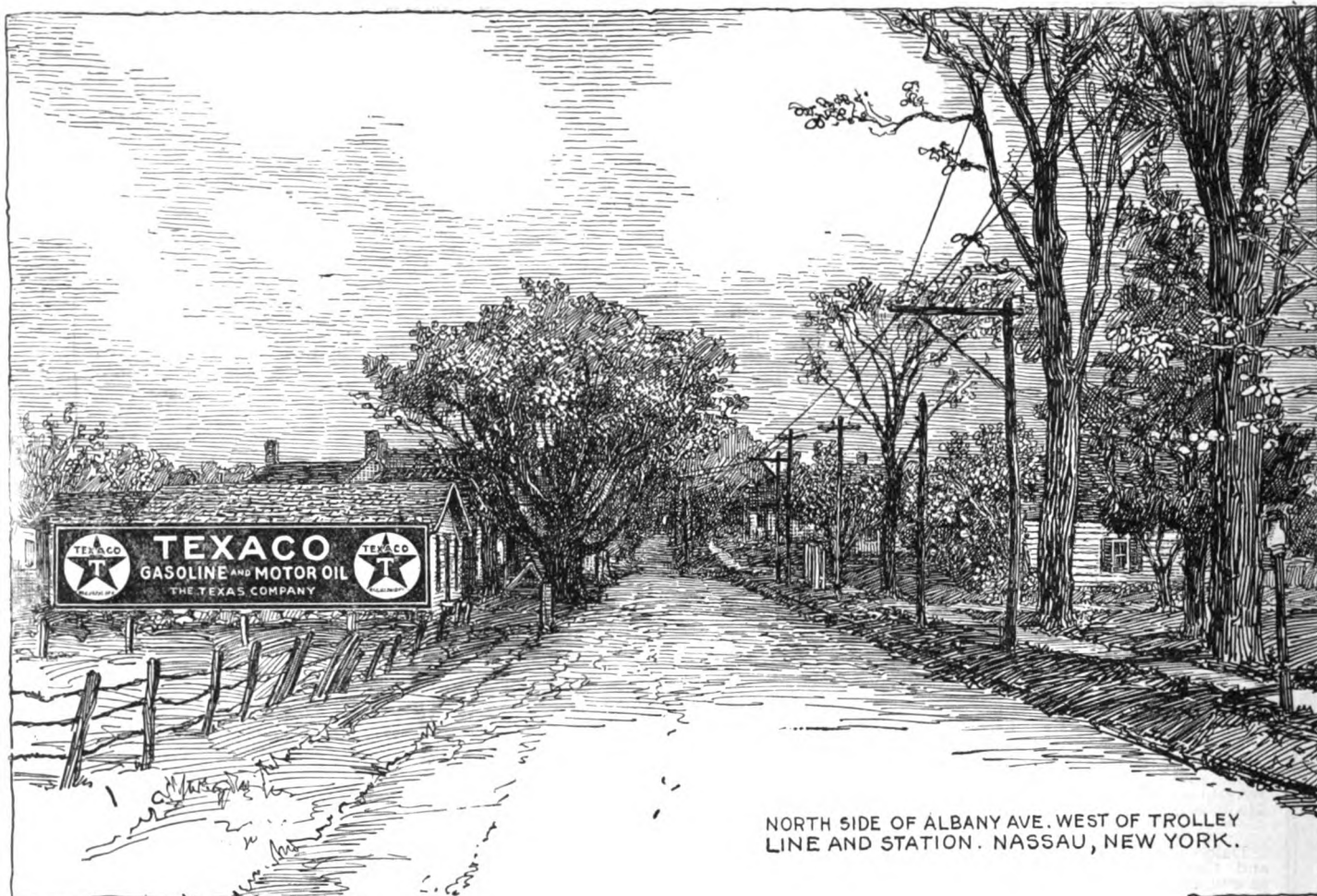
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changeably; they being expressed as 33,000 foot-pounds or 550 foot-pounds, as the case may be.

Electrical horsepower, or the power of an electric current to do work, is measured in kilo watts, which means 1000 watts. One electrical horsepower is equal practically to 750 watts. This figure is usually used in determining the effective force of the current.

GEARS CLASH.

(E. W., New York City.)

I have a ——— touring car. Recently I employed a new chauffeur. My former driver could make gear changes in silence but when the one now driving attempts to make a gear change on a steep grade there is a loud, clashing sound. What is the cause of this and how can it be overcome?

The cause of the clashing sound is that an attempt is made to mesh two gears that are revolving at different speeds. It can be overcome by what is commonly termed double kicking the clutch. Consider that the car is on a grade and a change from high to intermediate speed is necessary. Throw out the clutch and place the gear shifting lever in neutral. Next let in the clutch and slightly accelerate the engine. The clutch pedal can then be depressed and the change to the intermediate gear be made in silence. It will require a little practise before this suggestion will prove practical because the operations must take place very quickly and without hesitancy. It is imperative that the momentum of the car be maintained.

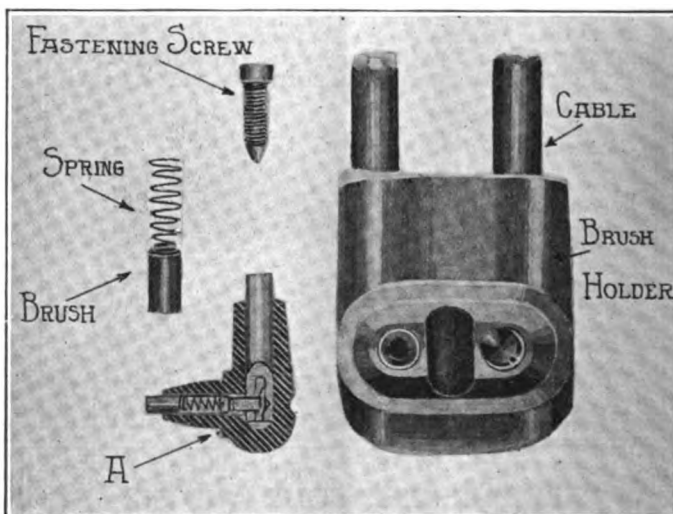
HOW CABLES ARE RETAINED.

(G. G. K., New Haven, Conn.)

I was much interested in your description of the Bosch NU4 type magneto which appeared in the last issue of The Automobile Journal. You state that the cables leading to the spark plugs are held by small screws. If you have a rough sketch of this construction handy, will you kindly publish it in the next issue?

(When Writing to Advertisers, Please Mention The Automobile Journal.)

An illustration of this construction is shown herewith. It will be noted that the cable has been bared of its insulation and an end is inserted through the opening of the holder until it reaches the bottom. Behind the carbon brush is a screw which is set up tight. The end of this screw passes



Double Brush Holder with Brush and Fastening Screw Displaced—A, Method of Retaining Strands of Wire and Efficient Connection.

between the strands of wire and locks them so that vibration will not cause the cable to become loose.

STARTING THE CAR WITHOUT A CRANK.

(C. J., Northampton, Mass.)

I happened to see an accident recently which so badly damaged the front of a machine as to bend the hand crank so

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 Graphite Automobile Lubricants

Write for booklet No. 210-G.
 Made in Jersey City, N. J. by the
JOSEPH DIXON CRUCIBLE CO.

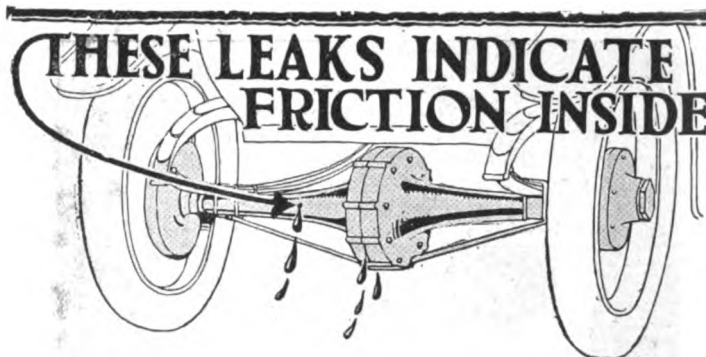
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Non-Fluid Oil is the ONLY specially prepared lubricant that lubricates *before* gears or bearings get hot. It is *always* in a lubricating state—it neither melts nor solidifies. Therefore it lubricates the very *instant* the parts begin to work, forestalling Friction and its evil effects.

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that it could not be used. The driver, however, simply jacked up one of the rear wheels, turned it and the motor started. What I am curious to find out is how he accomplished this. Can you enlighten me?

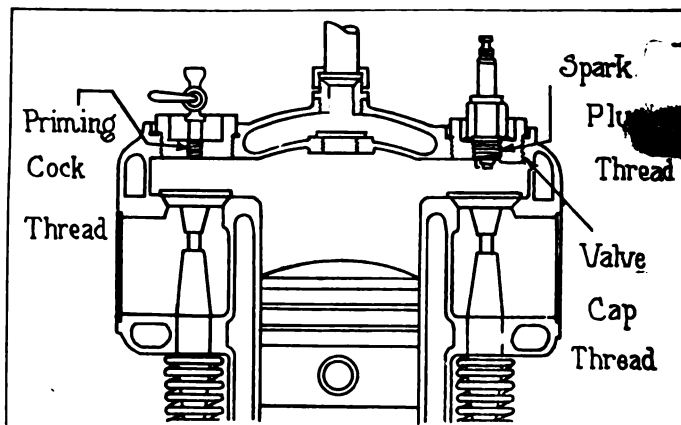
It is a simple trick and can be done by anyone. It consists of jacking up one of the rear wheels, engaging the high speed and letting in the clutch. Turn on the switch and place the spark and throttle levers in their customary position for starting. Grasp the jacked up wheel and turn it in the same direction as the car would travel if it were running. By this method it will be found that the crankshaft of the motor will be revolved, just as if it had been turned over by the hand crank. The action is transmitted through the differential, to the drive shaft, to the main transmission shaft, to the clutch and thence to the crankshaft of the motor.

Another method is to start the machine down a grade and after it has gained fair speed, switch on the ignition, engage the high speed and let in the clutch.

COMPRESSION.

Nearly every instruction book lays emphasis on the care of the car to prevent loss of compression. It is surprising, however, to note the number of machines taken to the repair shop to have the compression restored to one or more cylinders, which with a little thought and study of the instruction book may have been easily remedied at home.

To test the compression of a suspected cylinder, open the



If Connections Are Not Kept Tight Compression Will Leak Out and Result in Loss of Power—Illustration Shows Susceptible Points.

petcocks of all the cylinders except the one under suspicion, and then turn the motor over by hand until resistance is felt. If no resistance is encountered, it is positive proof that all the gas is leaking out. If, however, a resistance is felt, the crank should be held stationary against the same while the operator listens for a hissing noise. The accompanying illustration shows the points at which the gas has a tendency to leak by. Leaking around the threads of spark plugs, priming cocks, valve caps or by the gasket of a removable cylinder head are some of the commonest causes. These may be detected by squirting kerosene around the joints. If bubbles appear there is a leak. The remedy for these is obvious. Leaks by the piston rings and valves are troubles which should be remedied by the experienced repair man if the owner has not had experience along this line.

MENDING TEARS.

A common mistake is to mend torn leather and mohair cloth with hard woven thread. This repair is only temporary as the closely woven thread will quickly pull out and thus enlarge the tear. A more satisfactory and lasting repair can be made by using a soft yarn.

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Charlie Chaplin, fresh from signing his famous contract for \$670,000 per annum, was snapped, with "Sid," his brother, by an enterprising photographer. And, of course, the car near which they stood wore the Hartford Shock Absorber—"You'll See It Everywhere." The gentleman to the left is Charlie, the screen joy of the millions.

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WITH the action of its springs under perfect control, the sphere of a motor car's usefulness broadens perceptibly. Then no road can cause the slightest misgivings on the score of comfort. For when springs behave, the ruts and bumps of country pike are viewed with the same complacency and traversed with the same comfort as the smooth, even stretches of city boulevard.

The Hartford Shock Absorber positively makes automobile springs behave. Its control over them, while gentle, is none the less cer-



tain. The extreme of movement upward or downward, is impossible, so is harsh, nerve-racking oscillation.

A with-and-without demonstration is always convincing. There are certain roads which experience prompts you to shun. Hartford-equip and ride over them again. Mark well that now you glide where once you bumped.

The Hartford Shock Absorber is sold with the guarantee of Satisfaction or Money Back.

Mention make, year and model of car and we will send you our "Comfort Chart," which tells how to make your particular car doubly comfortable and longer-lived.

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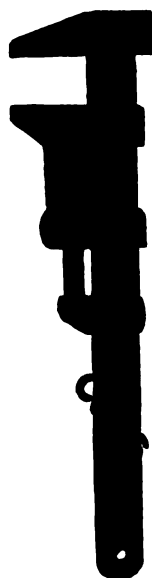
The material is selected with the same care, made by equally experienced and trained wrench makers, in a factory which specializes in wrench making. The wrenches are finished carefully and many times tested to assure the quality that will meet every requirement placed upon them.

Car owners who know wrench values demand the Coes. It is most popular with automobile repairmen, and in every other line of mechanical work Coes Wrenches will be found on the benches and in the tool kits of the expert workmen.

Coes wrenches can be had in just the size to fit any use. Any Coes will afford the same long and satisfactory service. It is always dependable and from the standpoint of wrench service it is the cheapest wrench produced.

Coes wrenches are sold wherever motor cars are used. They may be had of all jobbers, automobile supply houses, and automobile and hardware dealers.

Catalogue on request.



Coes Wrench Company, Worcester, Mass.



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Remittances:

Should be made by Check, Draft, Postoffice or Express Money Order, or Registered Letter. Money enclosures must be at sender's risk.

Entered as second class matter, April 15, 1906, at the Postoffice at Pawtucket, R. I., under Act of Congress of March 3, 1879

Ten Cents
a Copy

VOL. XLI.

JULY 25, 1916

NO. 12

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Treasurer - - WILLIAM H. BLACK

Secretary - - - D. O. BLACK, JR.

Published the 10th and 25th of each month by the

AUTOMOBILE JOURNAL PUB. CO.,
Times Building, Pawtucket, R. I.

IT HAS BEEN said that motor car owners in the United States do not get as much pleasure out of their cars, as regards long distance tours, as do the motorists of European countries. If this has been true in the past, it does not apply this year. A far greater number of car owners resident in this country are taking to the highways and by-ways of the several states this year than ever before. This statement is substantiated by reports from associations and individuals, who by reason of their interest in such matters, can be counted as authorities. Conspicuous among them is the Denver Motor Club which reports the traffic through Colorado double that of 1915.

THE Touring Editor is one who will vouch for the foregoing statement, he reporting that during the past month or so he has received an unprecedented number of requests for touring information, the queries coming from all parts of the country and from all walks of life. While the trans-continental routes are receiving their share of the traffic, it is noticeable that a great proportion of motorists, even from far western states, are either undertaking or considering quite lengthy journeys through New England's cities and mountains and along the Atlantic seaboard.

SUBSCRIBERS Should Avail themselves of the opportunity offered in the Touring Number of The Automobile Journal to make up tours to suit their individual desires, the information contained therein being arranged expressly for that purpose. The data by which tours can thus be compiled are to be found in the first advertising section, beginning on page 2, and the National Touring Map, on pages 24 and 25, affords an excellent means of following a route through the principal cities.

THE Second Installment of the Private Garage story is presented as the leading article of this number. This installment concerns the permanent type of structure, emphasis being laid upon the concrete, stucco, tile and brick buildings, which have been found so very desirable in practically all conditions. Its terms are general and are introductory to a series in which will be described in detail the construction of various types of garages, one suggestion to be presented in each issue of The Automobile Journal. Each will be illustrated with building plans and material specifications and where possible costs will be given.

THE Publisher Desires to call attention to a few facts concerning the patrons of the magazine's advertising columns. These manufacturers and distributors can be counted among the most progressive in the automobile industry and invariably are worthy of the fullest confidence on the part of the buyer. They are mostly leaders in their respective fields and treat their customers with uniform consideration and promptness. Readers should carefully study the advertising section, one of the most important departments of a modern magazine, and remember when considering a purchase, whether it be a car or an accessory, that it is good business to trade with the man who advertises his goods.

IF YOU Did Not Receive your copy of the Touring Number of The Automobile Journal, issue of July 10, notify the publication office at once. Do it immediately and the missing magazine will be sent promptly. The publisher is confident that every subscriber wants his or her copy of this very exceptional number. It is twice the size of the usual edition and contains touring data that cannot be duplicated elsewhere.

The Largest Gasoline Cars in the World are fired by Splitdorf Plugs

The 300 H. P., self-propelled, McKean gasoline rail cars are used for most difficult service in Australia, Mexico and the United States. The high efficiency of these great gasoline cars is another testimonial for the



SPLITDORF SPARK PLUG

With the Green Hexagonal Jacket

Ninety per cent. of all engine troubles are due to faulty ignition. Seventy-five per cent. of them can be remedied at once and forever by the use of Splitdorf Plugs.

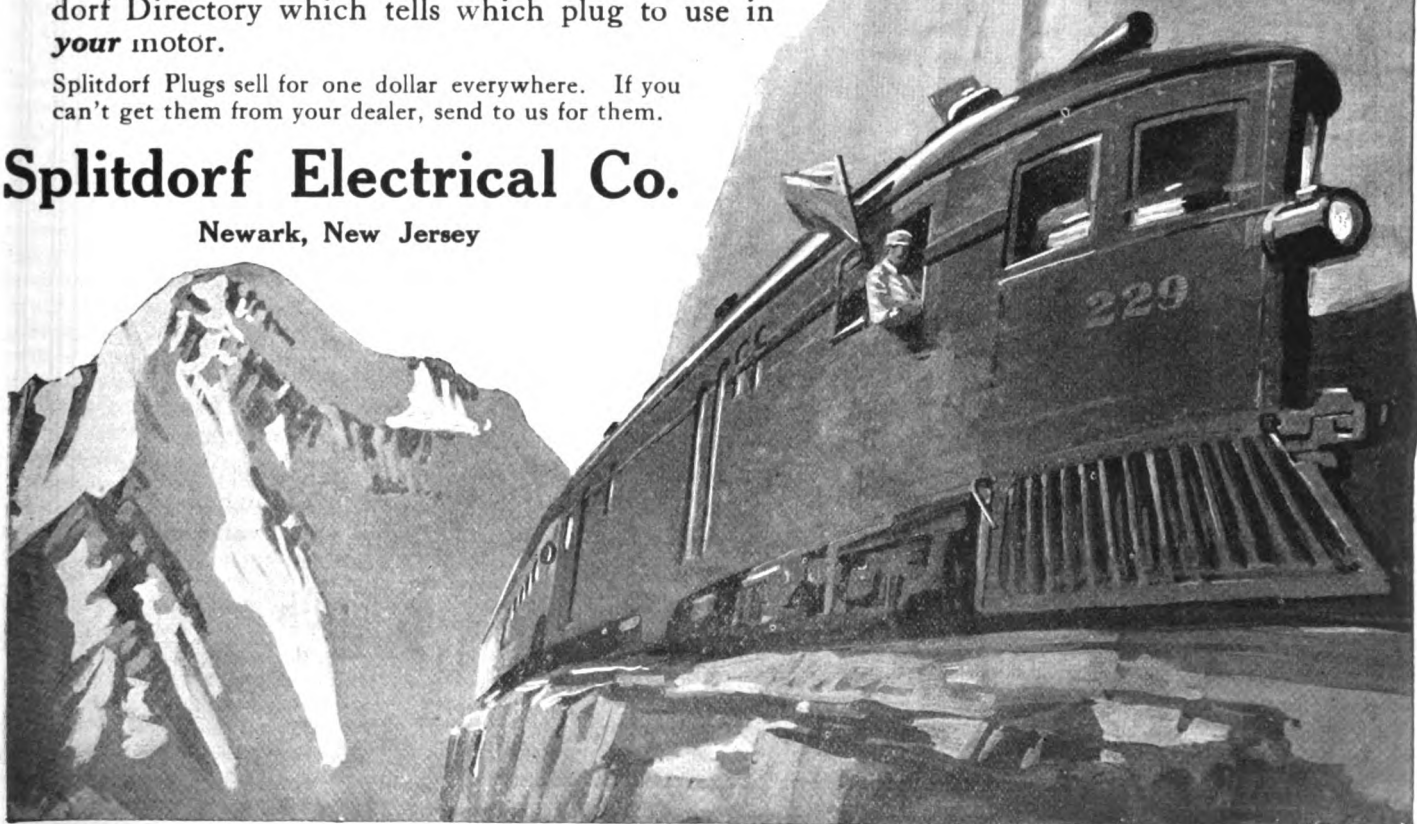
These plugs are practically indestructible, positively gas and oil tight. They are as nearly soot-proof as a plug can be. Dozens of times they have run 20,000 to 30,000 miles without ever having been cleaned.

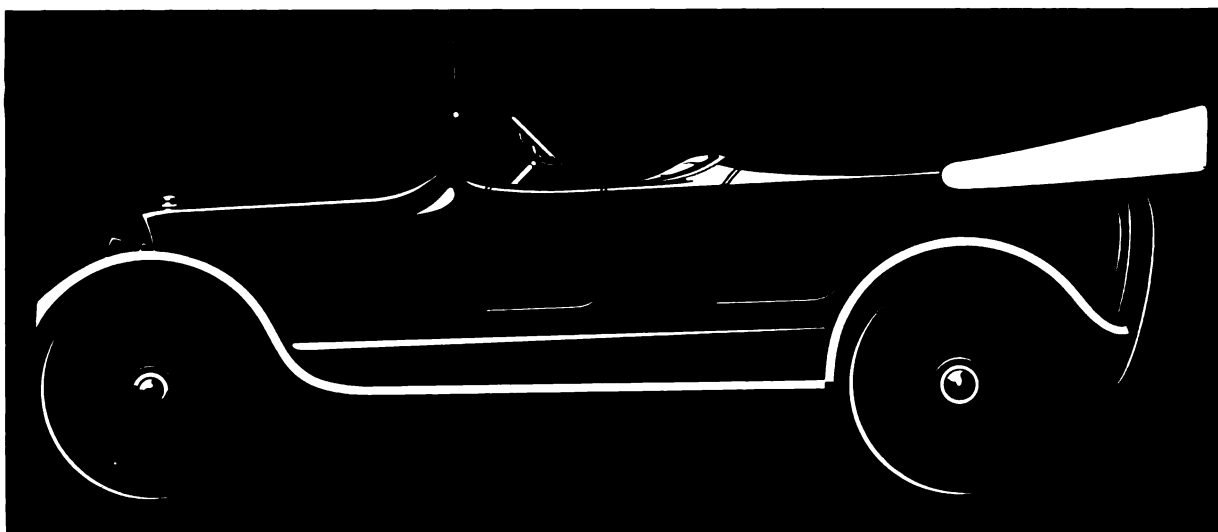
Made in all sizes and in types to suit every car, motorcycle, motor truck, motor boat, aeroplane, tractor, and stationary gasoline motor. Write for Splitdorf Directory which tells which plug to use in *your* motor.

Splitdorf Plugs sell for one dollar everywhere. If you can't get them from your dealer, send to us for them.

Splitdorf Electrical Co.

Newark, New Jersey





Can You -

before reading the copy below

Name The Car

of these dominant lines



Of course you can. It's the new Reo Six—the "fashion plate" from which so many other makers are now designing their next year's models. Those familiar lines—those graceful curves—catch your eye as the Reos glide by you on the road. We said "glide"—not speed. Note the distinction, for our ambition has been to build cars, not for those afflicted with the speed mania, but who crave the utmost in luxurious riding. Reos are for touring, not for the boulevards alone or the speedway. If you never have owned a Reo, never held the wheel yourself on a Reo Six, then you can but dimly appreciate what we mean when we say Reos "glide" by you. Just try it—the Reo "one-rod" control is so simple anyone, woman or man, who has ever driven any automobile, can drive a Reo without instructions. Note the smoothness with which the car accelerates—none of that tremor, that "palsied tremble" that indicates the flimsily made car. And you'll be surprised to find, when you actually put them side by side, how little difference there is in the "get-away" of this sturdily made, durable Reo Six, as compared with those for which that quality is the chief claim. Consensus of opinion is an excellent guide. Watch for the Reos—you'll be surprised at the number you'll see. Then, too, note the class of people who drive Reo Sixes—car owners are divisible into distinct classes, you know, and the comparisons furnish an interesting diversion on the road. You'll like the kind of people you see in Reos. They are your own kind. They are a class who desire real qualities in a car, not mere novelty. You can't mistake a Reo Six for any other. The lines of the Reo Six are distinctive as well as graceful and artistic. They are "the lines they are all quoting"—which is trade vernacular for copying. From that Reo radiator to the tire holder this car is distinctively Reo. You will enjoy the distinction of being seen and numbered among those who own Reo Sixes—it is the hallmark of good taste, evidence of faultless mechanical judgment and a knowledge of values.

Reo Motor Car Company, Lansing, Mich.

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Automobile Journal

JULY 25, 1916

VOL XLII

No. 12

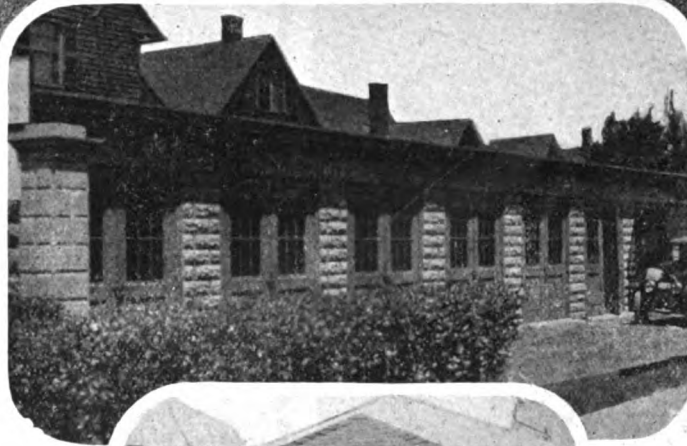
PRIVATE HOMES FOR THE CAR

A Beautiful Example of Concrete Private Garage with Pergola.

DECIDING on the type of garage to build is a problem, that when first taken up does not seem difficult but after a little inquiry and investigation, is found to present so many phases that the wise builder checks his first tendency toward a precipitate course of action and proceeds slowly, finding that there are as many things to consider as if he were planning a residence.

With the majority of automobile owners cost naturally is the first consideration when building a garage, although there are many who spare no expense to have a structure that is not only in harmony with the surrounding architectural effects but one that contains all the necessary equipment to take care of a machine. With the latter class of car owners, however, there is little need of investigating the proposition as they can call in a good architect and a reputable builder and the problem is solved with satisfaction. The majority, however, can not proceed in this manner as they are limited to a certain expenditure. Consequently they must spend some time in looking into the various methods of building, kinds and qualities of material and design, an occupation which should prove very interesting as the creative instinct in everyone feels a peculiar satisfaction in seeing the materialization of some carefully thought out plan whether it is in the form of a handsome building or a finely worked out piece of machinery.

Much depends upon the location of a garage. If it is to be erected in a closely built up residential section, and is to be in full view of the street, care should be taken that it not only harmonizes in design with the immediate environment but that it be of a type that would not have a deprecatory effect upon surrounding values. Often an illy designed garage will entirely spoil either the grouping effect of a set of build-



Photograph by the Courtesy of the Atlas Portland Cement Company.

ings or destroy the beauty of a scheme of landscape gardening. Where a garage is to be built on the outskirts of a city, or at a secluded summer place where appearance is not a factor, few phases enter the problem, but even in this case a careful investigation of the proper materials to be used will mean a big economy in the

long run. The location in this case would also call for the provision of room for more extras than would be necessary in a city garage where the supply houses are within a short distance. Gasoline and oil storage would also be taken into consideration.

To return to the subject of a city garage, the question of whether it is to be used for one or more cars is important, as is also the requirement of sleeping quarters for an attendant or chauffeur. In many sections, community garages are built, some being constructed as individual units, built in rows, while others as one large building with space for many cars. The individual garages, however, are more numerous and their construction interests the larger number of people, as many home owners, not anticipating the purchase of a motor car, did not

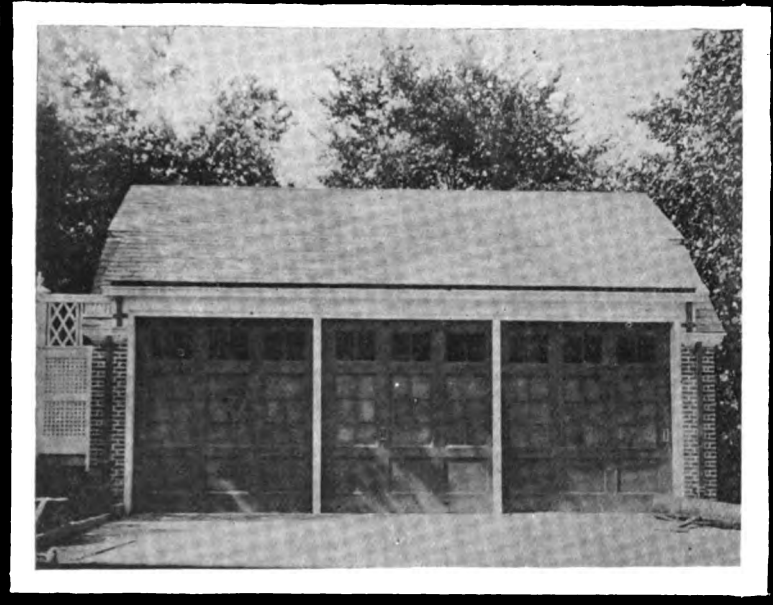
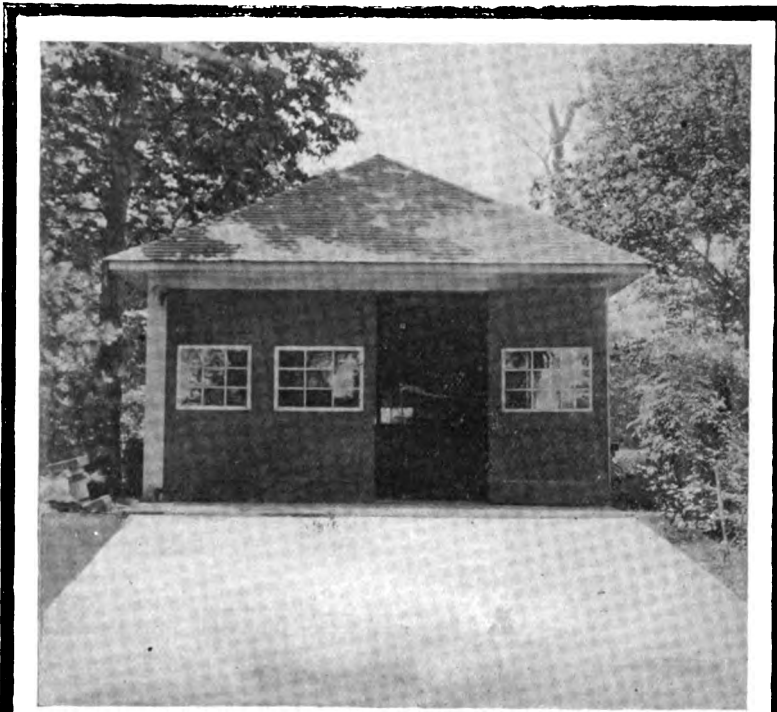
figure on erecting a second building on their lot. For this reason the location and size present a considerable problem.

Labor, material costs and finishing present questions that require study. Concrete, brick, tile and stucco structures require less finishing than wooden ones and the labor on them calls for a different kind of tradesman. A person at all handy with carpenters' tools can do a great amount of work on a wooden structure, while laying bricks, placing tiles and concrete blocks calls for an entirely different sort of training. The cost of labor is a large item in building (and also in maintenance) a fact which has made the concrete or brick type of garage very popular despite the higher first cost. The latter type also has advantages in the permanence of the struc-



Small Section of a Large Community Garage in Providence, R. I., and a Type of Modest One-Car Wooden Garage of Very Low Cost.

ture which should last a life time without even the cost of painting except possibly the doors or window frames and sashes. Some are built with wooden roofs which every 10 or 15 years would probably require reshingling.



A Double Capacity Garage of Wood, Built to Conform to a Wooden Residence, Above; A Partnership Garage Used by Three Neighbors, Below.

Concrete is one of the most flexible structural materials in use and can be worked into a myriad of designs and effects which makes it particularly adaptable for erecting garages to harmonize with any kind of a dwelling. It can also be used in combination with wood or can be colored to match any nearby structure and is practically the only material of which an ideal garage can be built throughout, including walls, roof, foundation and floor. Its use in the floor of a garage is compulsory in some cities and should be used in every case, as it soaks up dripping oil and is fireproof where a wooden floor soon becomes highly inflammable through being impregnated with both gasoline and lubricating materials.

Cement floors are best when made of a good mixture of concrete, while the walls and roof are subject to different



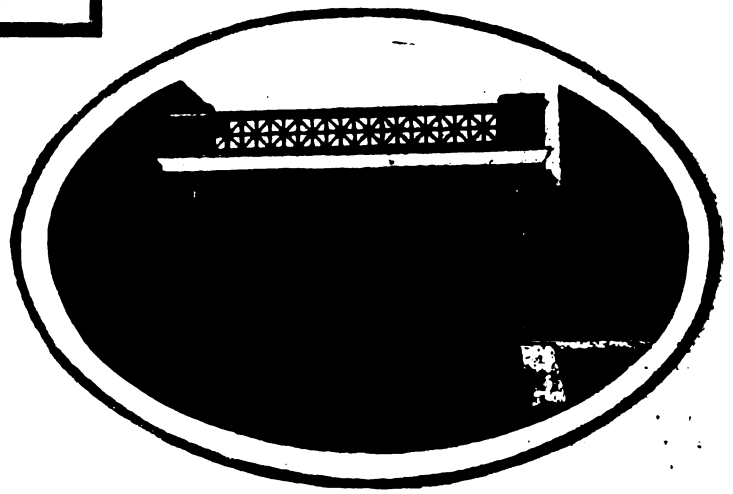
Modest Garage of Brick, Situated Near Street Line.

treatment. The cement blocks, cast in molds and then laid in tiers, are widely used in wall construction but the more recent method is through the use of molds and reinforcing rods. Putting up a metal frame to which is applied metal substitutes for laths and applying cement stucco as both an exterior and interior surface is another method quite generally used. A number of concerns make a patented metal lath or rib in sheets that is especially designed for cement construction and makes for both strength and economy.

As previously stated, the garage built of cement or concrete is the more costly at first, but the saving in maintenance costs would probably entirely offset the additional expense as compared to a wooden structure. There is no danger of its catching on fire, which eliminates the necessity of carrying insurance and it does not have to be painted every few years to keep its appearance.

The wooden garage possesses advantages in some respects. In the first place it is considerably cheaper to build and the labor cost is light. Once built, however, it requires considerable attention and being one of the best fuels for a fire is subject to danger from that source. Wood is often used as a material for garage construction where the owner desires to have a building to match the construction of his house.

There are a number of different methods of constructing garages with cement or concrete as the principal material. This difference lies mainly in



Brick Garage Abutting Sidewalk, Where Space was Limited.

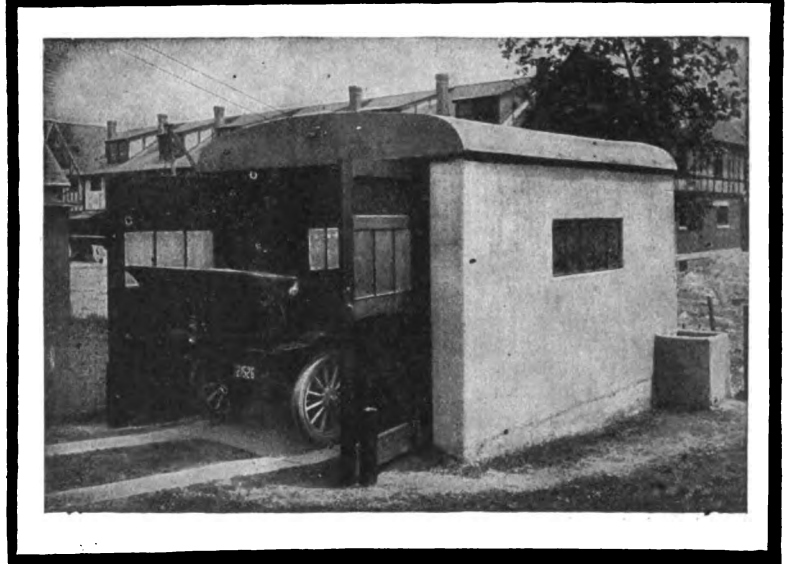
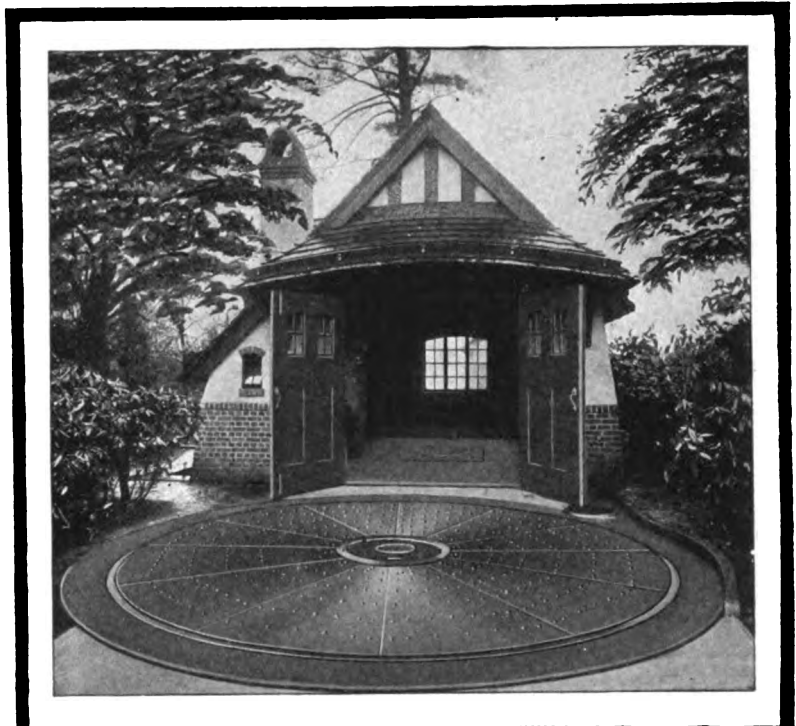


Splendid Example of a Two-Car Concrete Garage.

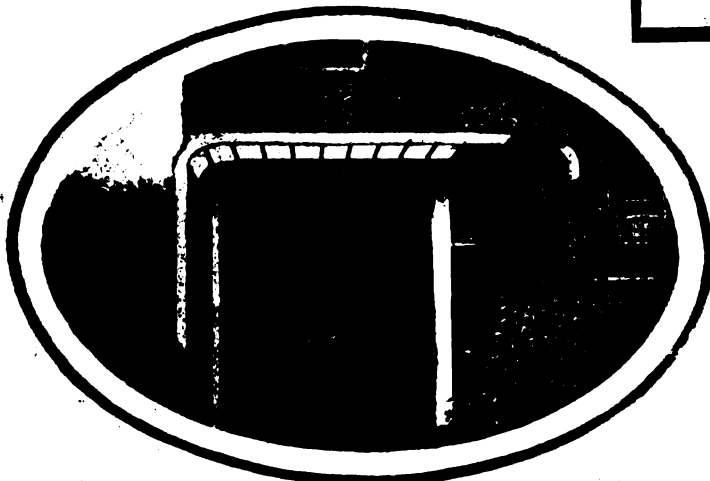
the frame construction wherein also lies the secret of the strength and durability of the structure. These various methods may be summed up briefly as follows: pipe frame, with metal lath; angle iron frame, with metal lath or substitute; wood stud framing; hollow tile, with cement stucco; concrete blocks, without the cement stucco; mass, or reinforced.

Where reinforcements are to be used in the concrete construction or a metal frame erected for a concrete or stucco finish there are a number of materials on the market manufactured for this specific purpose. One of the best known of these products is "Hy-Rib," made by the Trussed Concrete Steel Company of Youngstown, O. It is so designed that through its use all forms such as are used in the casting method are eliminated and no stiffening channels or wiring are needed. It also makes the construction thoroughly fireproof and makes for permanence and economy in labor.

Hy-Rib is made in sections of a single plate of steel, stiffened with rigid deep ribs and provides an ideal surface and key for plaster and cement. Its use is applicable in almost every case where cement is to be the main construction material. The manufacturers of Hy-Rib also make the Kahn pressed steel hollow stud which is used in the frame work with Hy-Rib, making a strong fireproof frame and base for any kind of cement construction. A book entitled "Hy-Rib" is published by the Trussed Con-



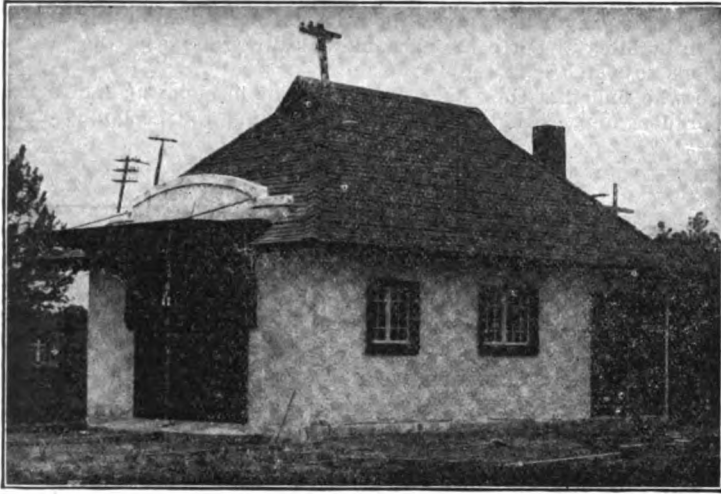
Canton Foundry & Machine Co.'s Outdoor Turntable, Above; A Low-Priced Concrete Garage with Hy-Rib Frame, in the Lower View.



Unusual Type of Garage, Showing It Built into a Residence.

construction of the garage in the hands of the architect as he will also look into the building laws which govern the erection of structures in almost every city. If a person, however, is to do this work himself he should at first make a careful study of the building laws which may be obtained of the building commissioner. In some communities the erection of garages also comes under the direction of the fire commissioner's department. Many cities permit the use of brick, cement, stone or hollow tile in constructing garages in the built up sections where the buildings are all brick, but the regulations throughout the country vary so much in their different requirements it would be futile to give their full scope and purport. A small charge is usually made by the city for issuing a building permit.

Aside from the convenience of having a garage either



A Novel Design of Concrete Covered Garage with Hy-Rib Frame.

close by the home or on a nearby lot, it should prove a great saving. The average charge is about \$5 a month for housing a machine in a public garage. This price might be said to represent the minimum, as in fact \$10 and even more is often charged in the larger cities; but assuming that the cost is \$60 a year, in 10 years this amount at 5 per cent. compound interest would total nearly \$800 or enough to build a very substantial and good appearing garage to house one or two cars. Where there is room it is often possible to erect a semi-private garage and make it pay for itself by building it to accommodate two or more cars and rent the additional space to neighboring motorists.

In most localities at present there is a big demand for garage space, the public establishments being overcrowded. The conveniences of having the garage close by the residence are almost too numerous to mention. The car is not only handy when wanted but on the return trip it is much more pleasant to have a trip end at the front door than in a garage some distance away, leaving the return home to be made on foot or in a street car. The car is also where the owner knows there is little risk of fire, theft or of its being tampered with by meddlers. It is also convenient when an owner does his own overhauling or repairing and for tuning up preparatory to a tour.

By installing an underground gasoline tank of 50 gallons capacity or more, further saving may be effected as gasoline may be purchased at the wholesale price, several cents under what is paid by buying in quantities sufficient only to fill the car tank. This saving alone in the course of 10 years would pay for a cheap garage and a considerable percentage of the cost of a big garage. One is also assured of starting off with a full tank without making a special trip to a gasoline station or garage to replenish the supply.

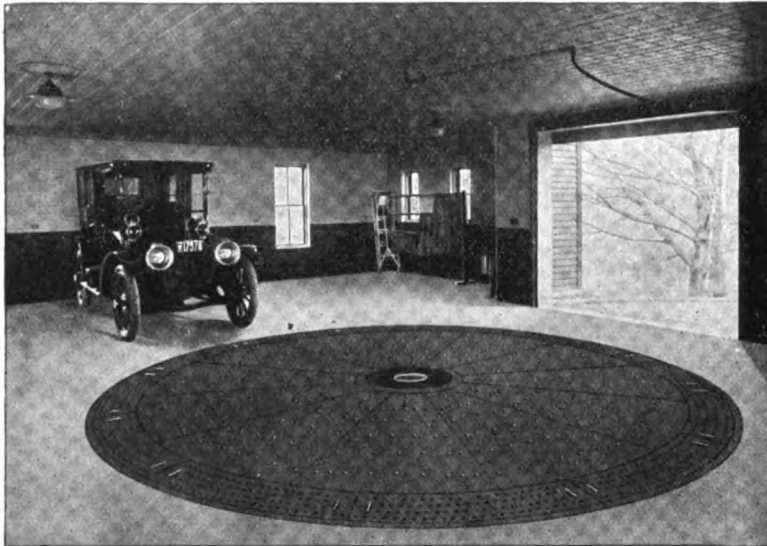
When the design has been decided upon and the choice of material made, the size is the next thing for consideration. This of course would be settled by the particular conditions governing the builder's requirements. For a single car, a garage 13x24 feet is considered ample as it allows a space of three feet around the largest cars, affording plenty of working space. Where space for an additional

car is to be provided the building should be widened to 23 feet with the same depth, 24 feet. From almost every point of view the two car size is preferable as it can be constructed for a small additional cost as compared with the single car garage and provides room in the event that the owner should keep two cars or, as previously stated, would be the source of considerable revenue.

Upon completion there are a number of conveniences that should be installed in a garage, one of the most important of which, next to the gasoline tank just mentioned, is a good sized sink with running water, both hot and cold, if possible. This not only provides an immediate source of water supply for the radiator but it is often convenient to have hot water handy in the winter to facilitate starting the motor and in cleaning the hands after working around the machine. A staunch workbench with vise is also very convenient. Heating equipment should be provided for garages to be used throughout the year as it not only eliminates the necessity of drawing the water out of the cooling system every night, but also makes the house comfortable to work in during the winter months. Electric lamps, with portable extension light, makes the best lighting equipment, but if electricity is not available an acetylene system affords a satisfactory substitute.

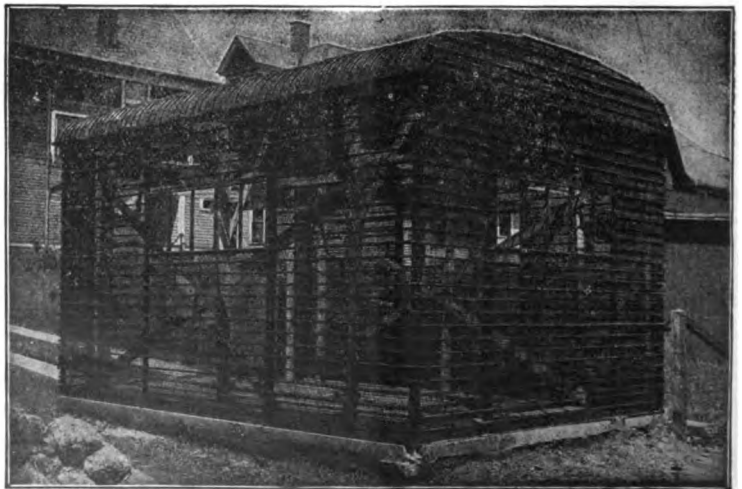
A turntable is a great convenience in a garage and should be installed where the question of expense is negligible.

Through its use a great deal of time and bother in moving the car about in a small radius is saved and it facilitates washing and repairing. There are a number of these turntables on the market. Their prices vary according to size. Only a slight pressure of the hand is required to turn the automobile to any angle when it is resting on the table, which enables the owner to drive directly into or out of his garage without backing. Where light is admitted to the garage from only one side, or at the door, it can be brought to bear directly upon that part of the car that is being washed or repaired. A turntable may also be installed outside



Canton Foundry & Machine Co.'s Indoor Turntable.

side in front of the garage but this location is not as practical as inside, as it necessitates backing into the garage after the machine has been turned around and requires that more attention be paid to the upkeep of the turntable.



Frame of Hy-Rib Garage Assembled Ready for Concrete Covering.

PLANS TO MAKE HIGHWAYS SAFE.

Massachusetts Takes the Lead in Preventing Accidents on Roads.

Through the general cooperation of the Massachusetts Highway Commission, railroads and motor clubs a plan is being formulated in that state for the purpose of preventing automobile accidents by removing the causes when possible and also by suppressing the reckless drivers and violators of the state's motor laws.

One of the important features of the new plan will be the thorough investigation to be conducted by the Highway Commission into every accident. To facilitate the operation of this plan the state has been divided into 14 sections each of which will have a resident investigator whose duty will be to delve into the minutest details of every accident. He will report to headquarters where the circumstances will be analysed to find if it is possible to remedy

Massachusetts the local police report these cases of law violations to the Highway Commission thereby relieving themselves of the responsibility and the Commission shows no partiality toward anyone.

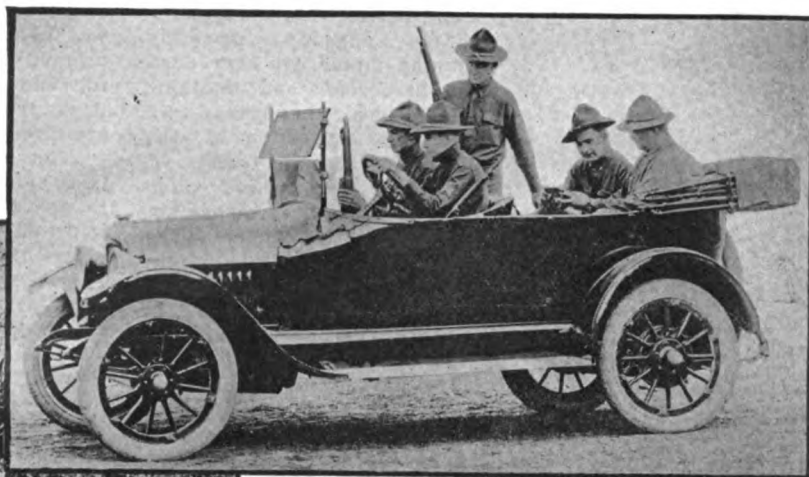
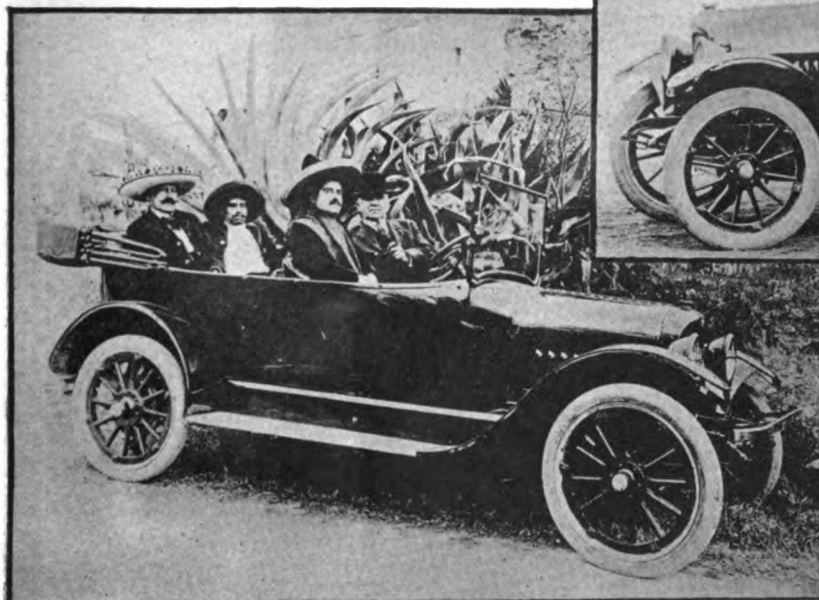
HEAVY TRAVEL TO DENVER.

The Denver Motor Club, which carefully watches the volume of motor travel in that Colorado city, reports that the travel by automobile to and through

the first of June has also been in greatly increased volume, which is partly ascribed to the effective advertising campaign in behalf of Denver's advantages as a touring rendezvous.

AVOIDS CLASHING OF GEARS.

The new Marmon 34 is equipped with an appliance that prevents the clashing of gears in the engaging of the starter. A pin is put into the projecting nut which holds the pinion on the shaft with a spring behind it. The pin enters into a spiral slot in the hub of the starter pinion and the spring is between the head of the nut and the head of the spiral, its function being to keep the spiral in forward position at all times. When the switch is closed and the teeth of the flywheel and the pinion strike



ALLEN CARS IN WAR TIME.

Among the Many Types of Pleasure Motor Cars that Have Been Adapted Either for Military Service in Connection with the United States-Mexican Trouble or by Individuals on Either Side the Allen Car Takes Conspicuous Position—At the Left Is Shown an Allen Car Which Was Sold to General Carranza, the Mexican Provisional President, for the Use of Himself and His Staff. At the Right Is a View of an Allen Car of Company D., 6th Regiment.

any condition that might have been the cause or to punish the individual or individuals who were responsible in case it was the result of criminal negligence or the violation of the law.

F. L. Austin, who has made a study of the subject, will have general charge of the investigators and it will be his duty to keep them posted in regard to any accidents that happen in their respective territories.

Massachusetts has long been the leader in this work, which is a great benefit to the general motoring public, as it greatly lessens the danger while travelling over the roads and it is expected that many other states will follow the good example set by the Bay State authorities. It has frequently been found difficult to rule off the roads careless automobilists on account of their influence in small communities, but in

Denver this year has been more than double what it was at this season in 1915. This is shown by the registration at the club and also by the large number of inquiries received from tourists.

Secretary Charles F. Roehring of the motor club says: "The travel from the East seems to be about equally apportioned on all the lines between the Lincoln Highway and the Santa Fe Trail and including those highways. A good deal of travel is coming from Texas and other southern points also. We are getting a surprising number of tourists from California. Most of this travel is coming by way of the Santa Fe Trail and the southwest. The mountain passes in Colorado are open now and if the weather continues good there is every indication that the motor travel to the state will maintain its present high volume."

Railroad travel through Denver since

against each other instead of engaging, the additional amount of draw-in pull of the starter shaft revolves the pinion by means of this spiral groove and pin. The amount of motion is equal to the circular pitch of the gear, consequently there is always enough to give one complete tooth turn.

OVERLAND PULLS HOUSE.

Ned Joyce, sales manager of the Carhart Motor Company of Tulsa, Okla., recently demonstrated the power of his 45-horsepower Overland in an unusual way. A house was being moved in his home town and the two horses that furnished the motive power for the operation seemed to be hardly equal to the task. Observing the strain on the animals, Joyce offered his car as a substitute.

Motor Touring Through the American Alps.

Five Days' Trip by Motor Car from Boston to the Beautiful White Mountains in New Hampshire—New England's Playground.

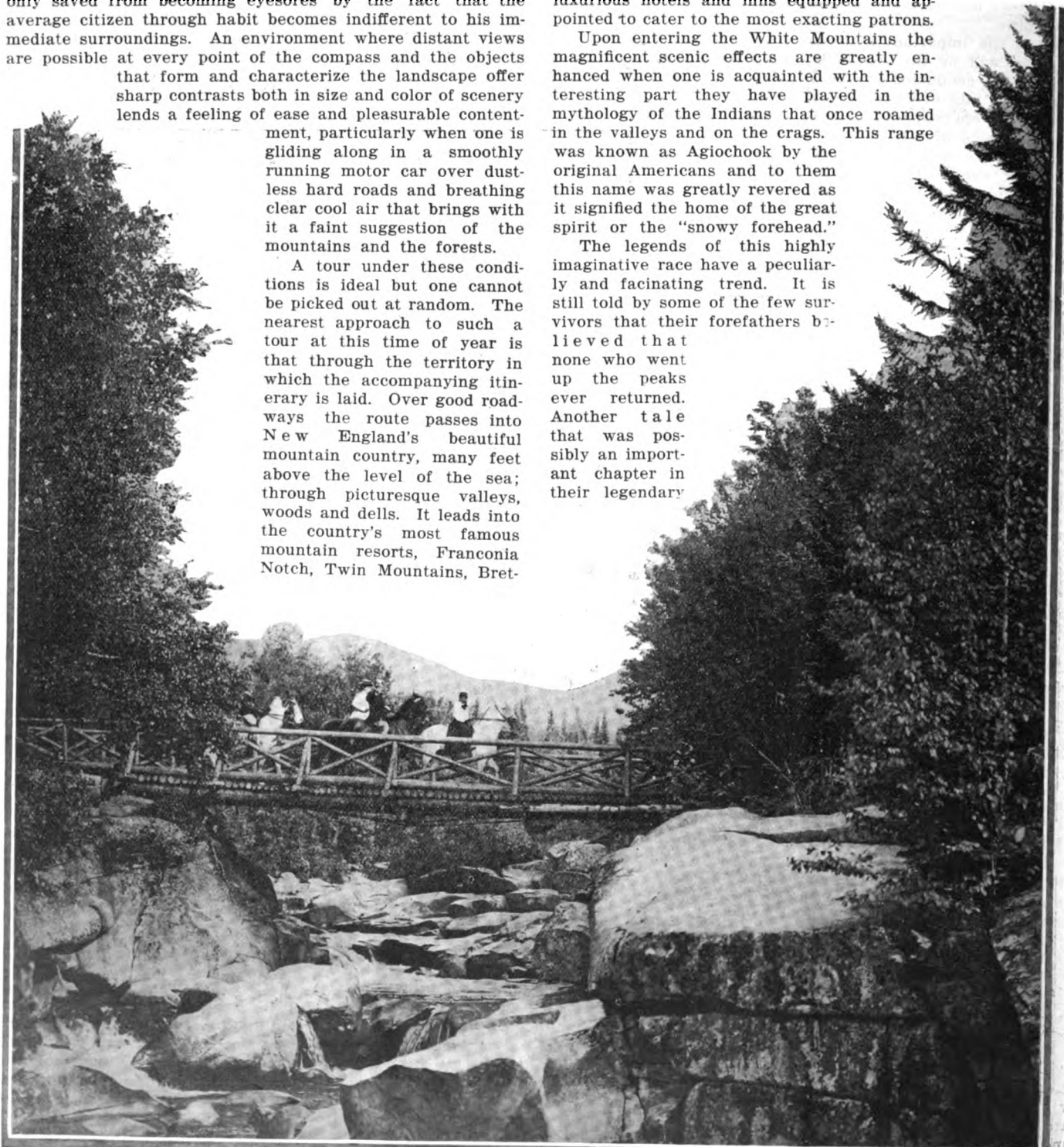
ONE of the greatest benefits of motor car touring is derived from the change of scenery it affords, and this in turn brings rest, ease of mind and exhilarating inspiration, if the trip to be made is laid out through the country where nature's great artistry is most in evidence. The idea is to get away from the artificial lines and landscapes wrought by man in the cities and suburbs, which are only saved from becoming eyesores by the fact that the average citizen through habit becomes indifferent to his immediate surroundings. An environment where distant views are possible at every point of the compass and the objects that form and characterize the landscape offer sharp contrasts both in size and color of scenery lends a feeling of ease and pleasurable contentment, particularly when one is gliding along in a smoothly running motor car over dustless hard roads and breathing clear cool air that brings with it a faint suggestion of the mountains and the forests.

A tour under these conditions is ideal but one cannot be picked out at random. The nearest approach to such a tour at this time of year is that through the territory in which the accompanying itinerary is laid. Over good roadways the route passes into New England's beautiful mountain country, many feet above the level of the sea; through picturesque valleys, woods and dells. It leads into the country's most famous mountain resorts, Franconia Notch, Twin Mountains, Bret-

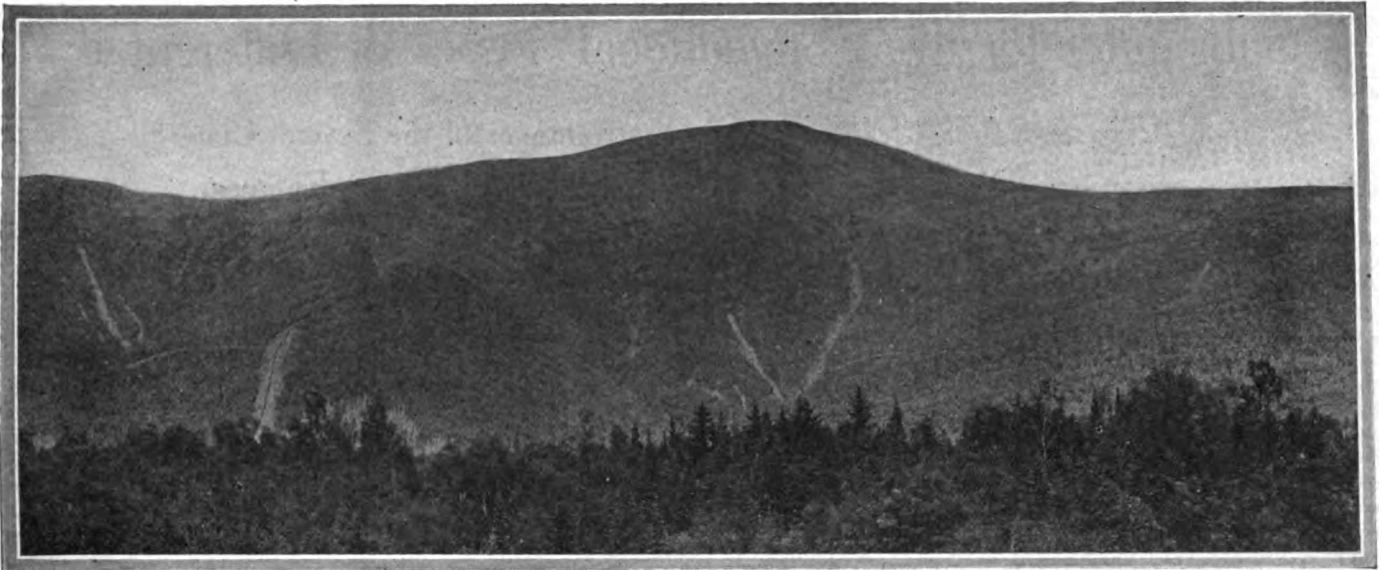
ton Woods, which are the playspots of thousands of people every summer owing to the ideal climatic conditions. Here are enjoyed all the pastimes that feature the great mountainous resorts of Europe, golf, horseback riding, motoring, fishing, swimming, mountain climbing and shooting. The entire route is dotted with rustic villages where accommodations may be secured and at the stopping points will be found luxurious hotels and inns equipped and appointed to cater to the most exacting patrons.

Upon entering the White Mountains the magnificent scenic effects are greatly enhanced when one is acquainted with the interesting part they have played in the mythology of the Indians that once roamed in the valleys and on the crags. This range was known as Agiochook by the original Americans and to them this name was greatly revered as it signified the home of the great spirit or the "snowy forehead."

The legends of this highly imaginative race have a peculiarly and fascinating trend. It is still told by some of the few survivors that their forefathers believed that none who went up the peaks ever returned. Another tale that was possibly an important chapter in their legendary



Famous Indian Leap at Bretton Woods, the Mecca of Recreationists.



Excellent Motor Roads Lead Up Mount Washington—A Scene Near Twin Rivers.

history, was of the miraculous escape of an ancient chieftain who was rescued by "the great spirit" from a flood that inundated the valleys and the hills, he together with his family being placed on the peak of a high mountain somewhat after the fashion of the biblical story of Noah's preservation in the great flood. Another chief according to this legendry, went forth upon the mountain to commune with messengers from the gods and was wafted into the happy hunting ground by the great spirits.

Starting from Boston the first day's run may be made either to Concord, N. H., or The Weirs, the former being 76.7 miles out while the latter makes a trip of over 113 miles. The next day's tour leads into the White Mountains where the over-night stop may be made at either Franconia Notch, Twin Mountains or at Bretton Woods all of which places afford the most luxurious hotel service. Doubling back from Bretton Woods to the Twin Mountains, the road leads north to Dixville Notch where the third night's stop may be made. A convenient

Boston to Concord.

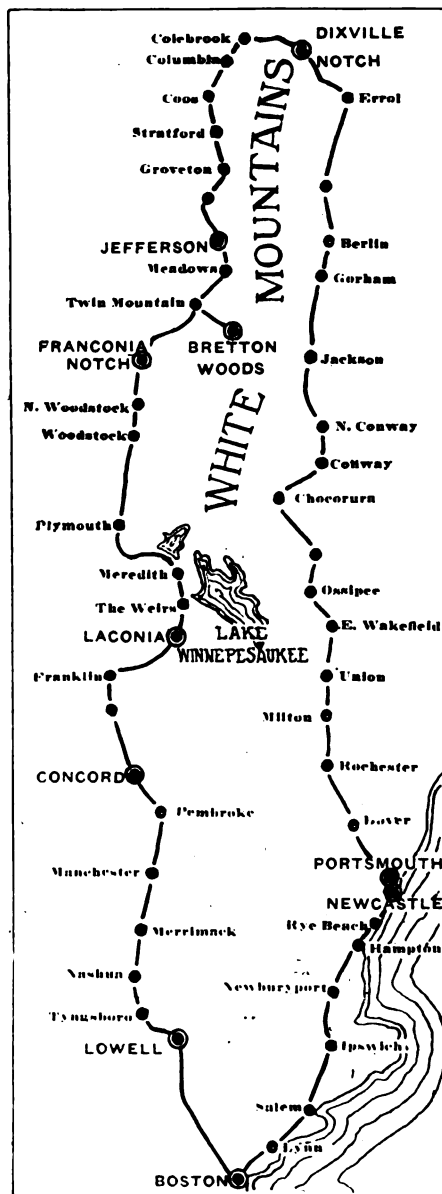
Boston	0.0	Nashua	40.1
Cambridge	2.8	Thorntons	46.0
Arlington	6.4	Merrimac	49.6
Burlington	13.8	Manchester	58.0
Billerica	19.3	Suncook	69.4
Lowell	25.5	Pembroke	70.8
Tyngsboro	33.6	Concord	76.7

Concord to Bretton Woods.

Concord	0.0	Ashland	54.2
Penacook	6.1	Plymouth	60.1
Franklin	18.3	W. Campton	67.6
Tilton	22.1	W. Thornton	73.1
Laconia	31.4	Woodstock	77.3
Lakeport	33.1	Franconia	91.9
The Weirs	37.7	Twin Mts.	105.2
Meredith	42.4	Fabyans	109.8
Holderness	50.2	Bretton W'ds.	110.5

Bretton Woods to Dixville Notch.

Bretton W'ds	0.0	Groveton	32.6
Twin Mt. Hs.	5.4	N. Stratford	46.1
Whitefield	14.0	Colebrook	59.3
Lancaster	22.5	Kidderville	66.0
Coos Jct	23.9	Dixville	69.7



Detailed Route Map of a Motor Car Tour Through the American Alps, from Boston to the White Mountains in New Hampshire and Return.

and not too tiring trip for the fourth day is to Conway, or Chocorua, while the fourth and fifth day's runs are to Portsmouth and to Boston respectively.

Striking the seacoast at Portsmouth a change of scenery is encountered which is a refreshing and delightful contrast, the remainder of the route passing down along the Atlantic seaboard through Rye Beach, Hampton Beach, Newburyport, Ipswich, Salem and Lynn.

Portsmouth, the last night-stop on the tour, is a very interesting city. In addition to being the only seaport in New Hampshire it contains many points of interest. Close by is the United States naval station at Kittery, Me., where there is usually a large number of warships assembled for maneuvers at this time of the year.

The tour covers a total of 493 miles on the trip from Boston to Dixville Notch and return and can be made in five days, allowing ample time for meals, rests at night and sightseeing. The itinerary is given below:

Dixville Notch to Gorham.

Dixville	0.0	Berlin	41.6
Errol	11.0	Gorham	48.0

Gorham to Portsmouth.

Gorham	0.0	C. Ossipee	58.5
Glen House	8.0	Ossipee	64.1
Jackson	20.1	N. Wakefield	69.2
Glen	22.9	Wakefield	74.2
Intervale	28.2	Union	79.5
N. Conway	30.1	N. Rochester	89.0
Conway	35.5	Rochester	94.1
Chocorua	49.2	Dover	105.5
W. Ossipee	52.3	Portsmouth	116.9

Portsmouth to Newburyport.

Portsmouth	0.0	Seabrook	19.2
Rye	5.6	Salisbury	22.5
Hampton	13.5	Newburyport	24.3

Newburyport to Boston.

Newburyport	0.0	Lynn	32.1
Rowley	7.7	Revere	38.1
Ipswich	11.4	Chelsea	41.1
Wenham	17.9	Medford	42.1
Beverly	22.5	Somerville	44.1
Salem	24.7	Cambridge	45.0
Swampscott	30.3	Boston	46.9

Substitutes for the Conventional Types of Differential.

Analysis of the Advantages and Disadvantages of the Several Constructions Discussed Before S. A. E. by Prominent Engineer.

By D. D. Ormsby,
Chief Engineer, Brown-Lipe-Chapin Company.

THE year 1915 stands out more than any other as one in which considerable effort was made to correct the inherent faults of the conventional type of differential. These efforts have extended into the present year and have been attended with much interest on the part of automobile engineers as well as gear accessory manufacturers. The outcome of present experiments will be of interest to all.

Before discussing the substitutes that have been designed to rectify the faults of the spur and bevel type differential, let us consider whether the standard types fail through inefficiency or because of too great efficiency. I believe the latter to be the fact. With these conventional gears we find that in making a turn the outer wheel, which travels the greater distance, accelerates and the

The substitutes can be divided into four classes: The free-wheel type (Figs. 1, 2 and 3); crank and eccentric (Fig. 4); spiral differential (Fig. 5); and the solid axle.

Fig. 1 shows the Hedgeland solid anti-skid automobile axle, of which little has been heard for some time. As the name indicates, this axle was constructed with a continuous or solid axle, having a thread cut on both ends. To these threaded ends were attached cone clutches having a double taper, so that when the power was applied to the axle these clutches were forced one way or the other by means of the thread on the shaft and they gripped a cup which was attached to the wheel, thus transmitting the power from the shaft to the wheel. When a car equipped with this device was making a turn or diverging from a

some other means to the shaft; when driving forward or backward they force rollers out against a drum to which is attached the sprocket or rear wheel. By wedging these rollers against the drum the power is transmitted from the cam to the drum and thence to the rear wheels. Both wheels are gripped alike when the car is being propelled in a straight line but when the car diverges from a straight line, as in turning a corner, the outer wheel runs faster than the inner wheel, forcing the rollers back so that it is released from the cam and hence from the shaft, and allowed to rotate faster than the inner wheel.

The substitute shown in Fig. 3 is of similar design to the one shown in Fig. 2, in that cams and rollers are employed, but it is mounted in the conventional position instead of in the hubs of the wheels, and its action is the same, that is, when the car is being driven in a straight line both cams are clutched to the drum which drives both wheels at the same speed. When the car ceases to run in a straight line the outer wheel accelerates ahead of the inner wheel, de-clutching the cam attached to the shaft of the outer wheel.

Free Wheel-Differentiation.

The action of the free-wheel type differential is such that it eliminates the inherent defect in the standard differential; that is, differentiation when the wheels have unequal traction. Yet there are some points in its action which are not entirely satisfactory. In the first place, with unequal size tires it drives more on the large tire, because the wheel with smaller tire has to rotate faster to make up for the distance traveled by the wheel having the larger tire. Secondly, in making a turn all the power is applied to the inner wheel and hence must be transmitted through one shaft. This throws an extra heavy load on the inner wheel, especially when making a turn on a steep hill. One other feature has, according to the experience of a car manufacturer, proved to be a serious defect. This is the shock of applying the brake when the car is not running in a straight line, for when making a turn the outer wheel, being free from the axle, is more sensitive to the brake than the wheel which is transmitting power. The outer wheel will be retarded much more rapidly than the inner wheel. There is considerable shock when it slows down to a point slower than the inner wheel, and the differentiating mechanism is obliged to pick it up.

The second type of differential substitute is shown in Fig. 4. For convenience I will call it the crank and eccentric

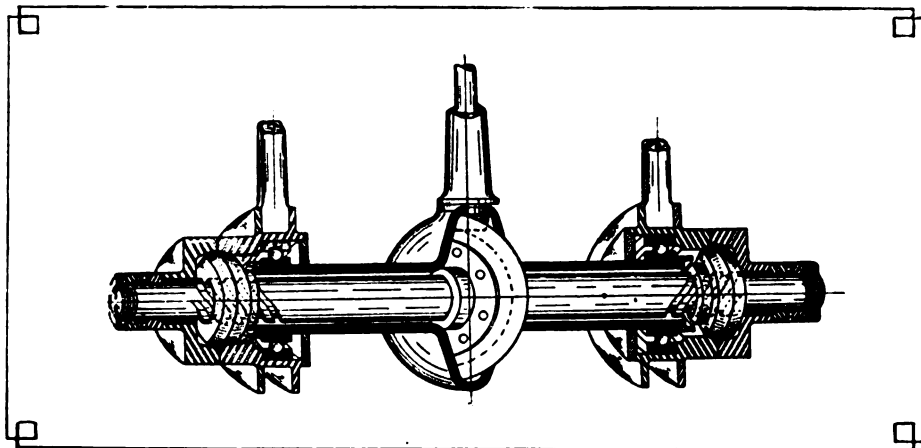


Fig. 1—Hedgeland Anti-Skid Axle.

inner wheel retards, this being the desired action. There is another difference which the standard differential takes care of; that is, a difference in load which is caused by unequal traction of the wheels, by allowing the wheel having the lesser load to revolve faster than the one having the greater load.

From the above, one can see that the conventional differential rather than being inefficient is on the other hand too efficient in that it differentiates for all differences, whereas the automobile engineer wants it to take care only of the unequal velocities of the rear wheels. It becomes inefficient as a means of transmitting the power to the rear wheel if the wheels have unequal traction. It is to correct this defect of differentiating for unequal traction of the wheels that a great many intended substitutes for the present type of differential have been invented. I will describe a few of them briefly.

straight course, so that the outer wheel was obliged to travel faster than the inner wheel, the outer wheel was automatically de-clutched and ran free on the axle around the clutch on the shaft. Fig. 1 is a sectional line drawing of this construction, and shows the mechanism clearly.

Fig. 2 represents a design similar to the one in Fig. 1, and the same principle is utilized, namely, having a loose wheel when the car is diverged from a straight line, so as to differentiate for the unequal velocity of the two rear wheels. Fig. 2 is a perspective view of a jack-shaft equipped with this design. It is practically the same as the Hedgeland design, with the exception of the clutching mechanism, in that it employs a solid axle, to the center of which is fastened the bevel drive gear and on the ends of which the clutches are applied. In this case the clutches consist of two cams on each side, keyed or secured by

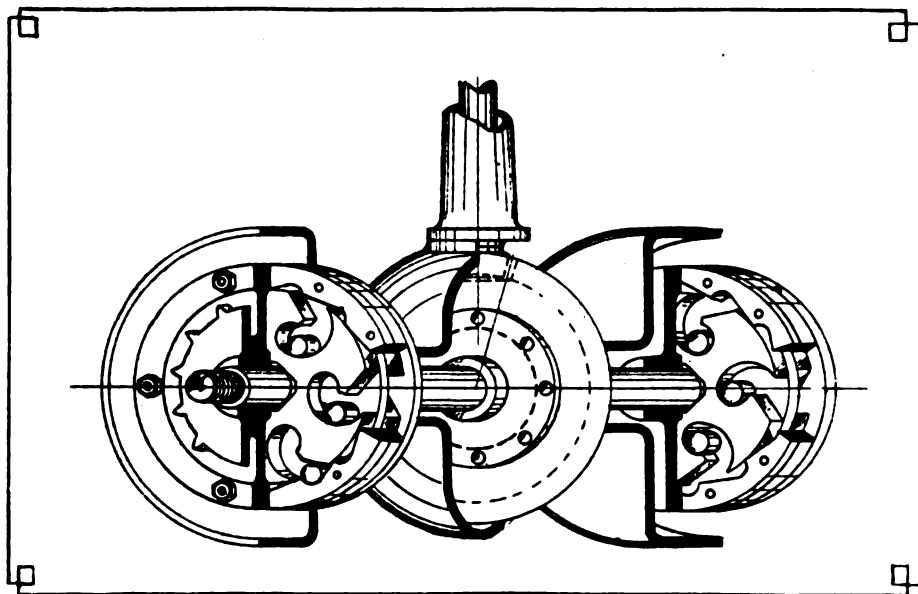


Fig. 2—Free-Wheel Type of Axle.

type. I was unable to obtain the name of the inventor of this differential and believe it has not been tried out to any great extent. It is an interesting device composed of two axle shafts designated as C and D in the reproduction. At the ends of these shafts are turned two eccentrics, to which are attached four cranks, designated H, K, J and L; H, K being attached to the eccentrics on shaft D and J, L to the eccentric on shaft C. These cranks carry bosses which are bored and through which are passed sliding pins E and I, upon which the cranks are centered and oscillate. The cranks L and H are attached to sliding pin E and J and K to sliding pin I. These pins are allowed to slide in slots in the case F, which is made in two halves bolted together. The action is as follows: The power applied to the bevel driving pinion A is transmitted to drive gear B, which is attached to and therefore rotates the case with the gear. When the car is traveling in a straight line, the sliding pins E and I rotate with the case, and the whole differential mechanism is rotated. When the car diverges from a straight line and the wheels have unequal velocities, the outer wheel speeding up oscillates the cranks by means of the eccentrics on the shaft, the cranks being allowed to oscillate around the center of the axis of the shafts and the eccentrics placed at such an angle in relation to each other that the required reverse direction of motion of the shaft is obtained. This allows the outer wheel to speed up and the inner wheel to become retarded, but because the angles of the eccentrics are so sharp, when one wheel loses traction it does not spin. I have never seen one of these differentials tried out and do not know how efficient it is, but it is ingenious and unique.

The third type, which has received considerable attention, is the spiral gear. This differential is similar to the conventional type, except that its differentiating gears are made up of a train of spiral instead of bevel or spur gears.

Its action is the same in principle as that of the bevel or spur gear types, but the spiral gears are placed in such a manner as render the differential train inefficient, so that it is impossible to spin one wheel without rotating the other. Fig. 5 is a perspective sectional view of the type. It seems that a design of this nature should be the ultimate solution of the present differential problem, for it is evident that both wheels should be connected to each other at all times by some means and that the power should be applied to both wheels under all conditions, which is accomplished in this design. This type is being used with marked success by one company in four-wheel drive trucks.

Differential Eliminated.

The fourth "substitute" consists of the elimination of the differential altogether. The advantages of this construction are that it obviates the spinning of the wheels, insures a positive drive of the wheels under all conditions and makes possible a reduction in cost. The disadvantages are, however, in my opinion, too great to be overcome. Writers in

the trade papers seem to advance the theory that the slippage is greater in making a short turn than in making a turn of larger radius through a given angle. In the solid type axle with the differential eliminated there must always occur, when the car is making a turn, slippage of the inner or outer wheel, or both wheels. It is hard to demonstrate exactly what happens. I have figured just how much slippage there is in making a turn of 90 deg. with a certain light touring car and a well-known runabout. I found by measuring the amount the front wheels can be turned in steering, that the touring car can be turned in a radius of 17.13 ft. (205.6 in.). This is the radius at which the inner wheel turns. The standard gauge being 56 in., the outer wheel would turn in a radius of 261.6 in. The distance traveled by the outer wheel in a 90 deg. turn is 410.9 in. The inner wheel would travel 322.9.; a difference of 88 in. to be compensated for by the slippage of the wheels. The total circumference of the touring car 32 in. tire is 100.53 in. The amount of slippage divided by the circumference of the tire gives the proportion of revolution which the wheel has to slip in making a turn of 90 deg., and is 0.87.

The shortest radius at which the runabout examined can be turned is 13.9 ft. or 166.7 in. This is the radius at which the inner wheel turns. The outer wheel radius is 222.7 in. The distance the outer wheel travels in making a turn of 90 deg. with this radius is 350 in. The inner wheel travels 262 in. in making the same turn, the difference being 88 in., the same as with the touring car. I proved to my own satisfaction that the difference in travel between the inner and outer wheels in making a turn at a given angle depends upon the gauge and not upon the radius of the turn. Taking the runabout tire diameter as 30 in., the circumference is 94.248 in. and the amount the wheel would have to slip 88 in. This divided by the circumference of the tire gives the part of the revolution that the wheel has to slip in making a turn of 90 deg., which is 0.93. No matter how great the radius, the amount

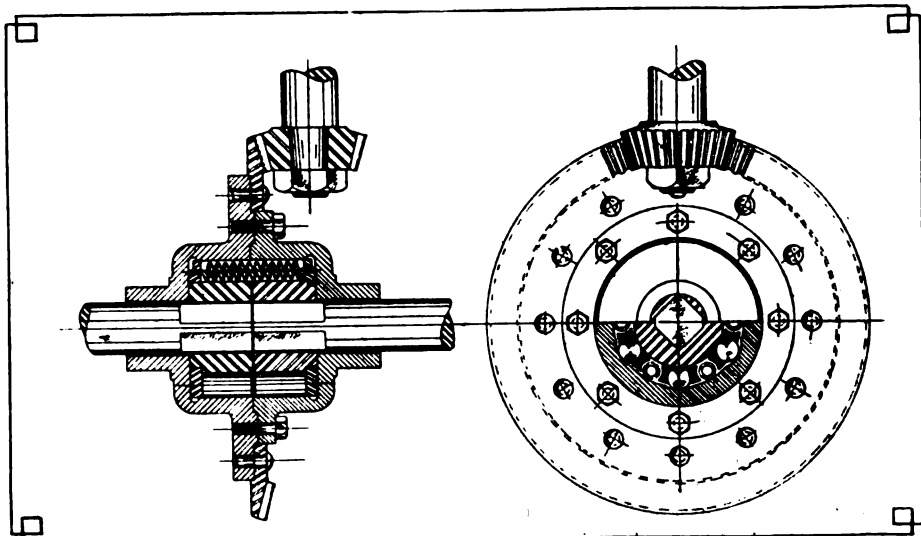


Fig. 3—Cam and Roller Type of Free-Wheel Mechanism.

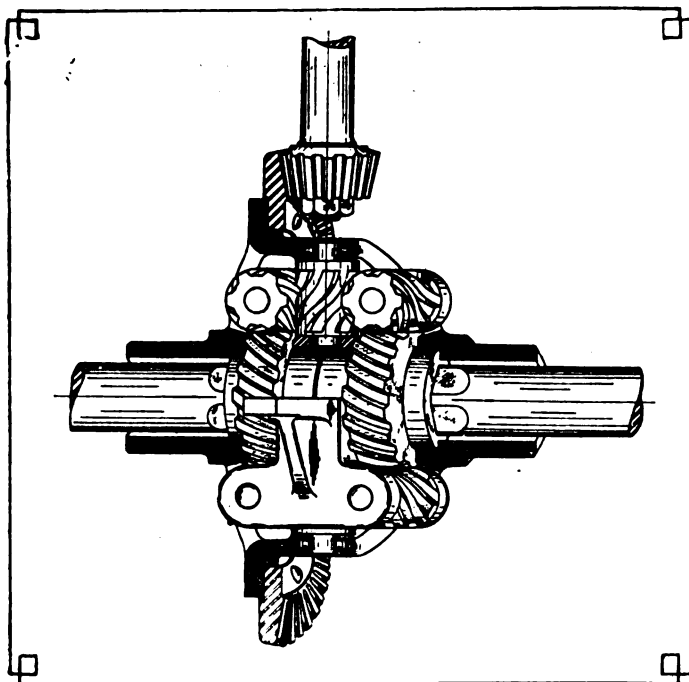


Fig. 5—Differential with Spiral Gears.

of slippage through a given angle is always the same, for the difference in travel depends upon the gauge and not upon the radius. Therefore with a solid axle no matter how slight the divergence from a straight line, an extra load, caused by the difference in travel of the two wheels, is always thrown upon the rear axle, wheels and tires. With a larger radius the slippage is not so noticeable, of course, as it occurs through a greater space.

Another objectionable feature in a solid axle is the additional power consumed in making a short turn, by being obliged to slip one or both wheels, for with a heavy loaded car or truck, when the slippage must take place in a short distance, the amount of slippage is greater in proportion to the distance traveled than it is on a long turn and the ratio of slippage is greater in proportion to the percentage of distance rolled by the wheels. Practical demonstration of this has been given by different manufacturers. One of these said: "A truck equipped with a solid axle could not be pushed by hand with the wheels cramped at an acute angle, whereas when parallel so as to cause the truck to travel in a straight line, it could be pushed easily. The truck was harder and harder to push as the wheels were turned, until a point was reached at which it could be moved."

Another condition which the solid axle does compensate for is unequal size of tires. It is certain that both tires on the rear wheels will not always be changed simultaneously. For easy figuring we will say that a truck is equipped on the rear wheels with two tires, one of which is one inch smaller than the other. Then with each revolution of the wheels one will have to travel 3.1416 inches farther than the other. To make up for the greater distance traveled by the larger wheel, the smaller wheel must slide this difference, or the larger wheel

must slip part of the time to compensate for the lesser distance traveled by the smaller wheel. This certainly would cause excessive wear on a new tire until both wheels were brought to a uniform size.

It may be of interest to know that street car manufacturers are considering the adoption of differentials for street cars, to eliminate the corrugation of rails and wheels, as well as to economize on the consumption of power. G. M. Cameron, master mechanic of the New York State Railways at

Rochester, N. Y., gave the writer the results of an experiment he conducted recently on two street cars, one having a solid axle of the standard type and the other being equipped with loose wheels so as to obtain a differentiating means. The following is a report of the current consumption of the two cars:

Car 1 was equipped with a solid axle and traveled a continuous loop for a distance of 23,562 feet or 4.46 miles. The average speed was 10.11 m.p.h. The average kilowatt-hours per car-mile was 1.542, and the average watt hours per 10 miles 99.5. The second car was equipped with an axle having a loose wheel, to allow for any difference in speed of the two wheels. The total distance traveled was 27,720 feet or 5.25 miles. The average speed of the car was 10.10 miles per hour. The average kilowatt-hours per car mile was 0.737, and the

average watt-hours per 10 miles 50.5, or about one-half.

It is evident that greater economy is obtainable in the operation of a car equipped with a differentiating means to compensate for the difference in speeds of the rear wheels, in not only power consumption but in wear-and-tear on the parts, for if more power is consumed with a solid axle, there are greater loads on the working parts which are obliged to transmit the power.

It is my belief that the ultimate differential will be one which is free to compensate for the differences in speeds of the rear wheels when the car diverges from a straight course, and so constructed that it will be impossible for the wheels to spin when one or the other has lost traction. I believe that the present type of differential, constructed so that the differential train will not be quite so efficient, would accomplish the purpose. The present differential is too efficient as far as the differentiating mechanism is concerned. If one were designed in which this excess efficiency could be curtailed, the result would be what is required. The spiral gear type seems to fulfill the requirements more adequately than any of the others.

MARMON'S SPECIAL FEATURES.

The Nordyke & Marmon Company, of Indianapolis, Ind., maker of the Marmon car, will introduce some new enclosed body types of exceptional design on their fall output. These bodies, which are to be placed on the Marmon 34 chassis that has met with such popular approval, are to be of special construction and will be made by some of the leading custom coach builders of the United States, including Holbrook & Company, New Haven Carriage Company, Kimball & Company and the E. J. Thompson Company. The bodies will be designed for lightness, being constructed almost wholly from aluminum and will be ready for delivery during August and September.

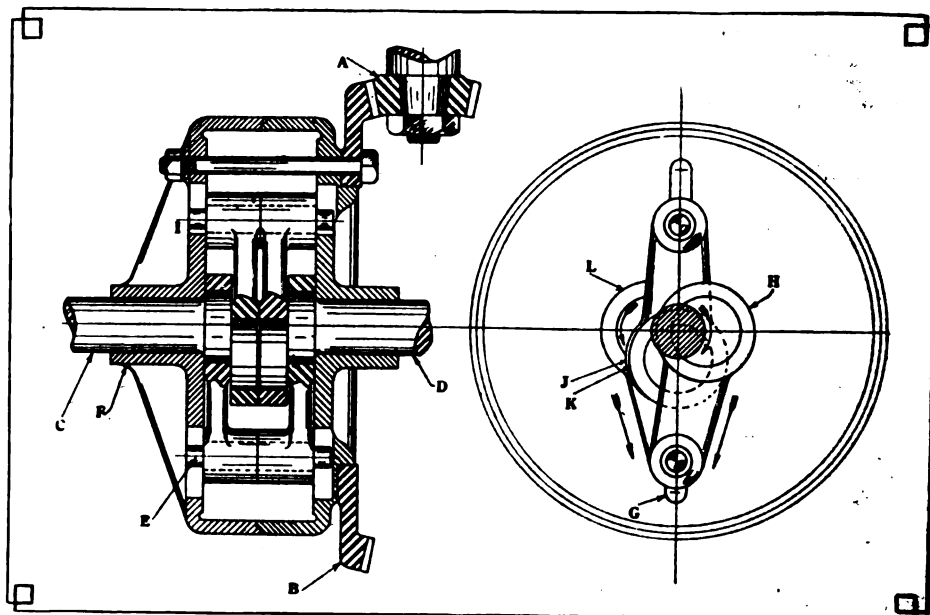
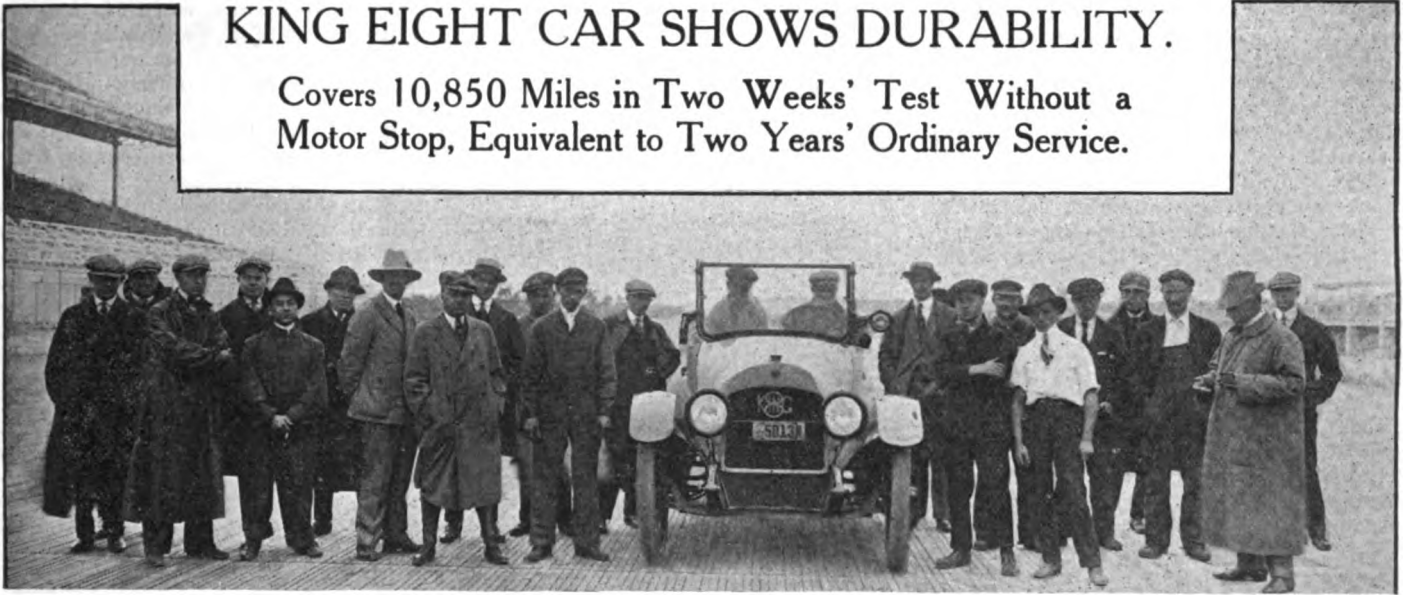


Fig. 4—Crank and Eccentric Type Differential.

KING EIGHT CAR SHOWS DURABILITY.

Covers 10,850 Miles in Two Weeks' Test Without a Motor Stop, Equivalent to Two Years' Ordinary Service.



NEARLY 11,000 miles in two weeks of day and night driving without mechanical adjustments or repairs of any kind is the record established by a seven passenger eight-cylinder stock King car, in a test sanctioned and supervised by officials of the American Automobile Association on the Sheepshead Bay speedway and Long Island highways.

The conditions of the test were specifically designed to approximate those under which an owner operates his car. The machine travelled through fog and

once nor was any adjustment made upon it, the only stops being for the purpose of taking on gasoline, oil and

TECHNICAL DETAILS OF THE KING MODEL E CAR.

Make of Motor.....	King
Cylinders	Eight
Bore and Stroke	3 by 5
Shape of Motor	V
Horsepower (S. A. E.).....	28.8
Carburetor	Ball
Ignition	Atwater-Kent
Gasoline feed	Carter gravity
Start and Light....	Ward-Leonard
Clutch	Plate
Gearset	Selective, three
Wheelbase	120 in.
Tires	Firestone, 34x4
Rear Axle.....	American, floating
Price of car	\$1350

water and changing driving crews. Not even a spark plug was removed nor the

valves touched during the test.

The total time lost in making the necessary stops was about 15½ hours, which on the basis of the distance travelled, shows the King owner as spending about nine minutes a week on the maintenance of his car. This was proved conclusively by the test as the time necessary to keep a King eight in perfect running condition for 10,850 miles, which is the exact distance travelled in the two weeks.

It was evident that the car could have been run another 10,000 miles and even



rain, night and day, for 336 hours with driver and mechanic, and 450 pounds of sand in the tonneau to represent a full passenger load.

So consistent was the performance of the car in achieving its average of 34 miles per hour that there were scores of circuits of the speedway made in which there was less than a second's variation in time. During the 14 days and nights the motor was not stopped



SCENES ENACTED DURING THE KING EIGHT OWNERS SERVICE TEST.

The Start Is Depleted in the Illustration at Top of the Page; In the Circle to the Left Is Shown the Car Finishing the Last 200 Miles on the Roads of Long Island; In Circle at the Right Is Shown Assistant Engineer C. E. Jacobs Instructing the King Driver As He Flashes By; In the Final View Shows the Car After the Contest, Standing Before the New York City King Headquarters, with President Artemas Ward, Jr., Peering Into the Car.

much further, but it was the desire of the King company only to demonstrate that its stock car could be run for a greater mileage than the average owner achieves in two years without any replacements of parts or more than ordinary adjustments.

Of the 14 days of the test, one was spent off the speedway, this being necessitated by the previous reservation of the track for the

annual games of the New York police department. During that time the car was driven to the Long Island Motor parkway, official observers being in charge, and was run up and down that thoroughfare until the oval was again available.

The vehicle was a King registered stock seven passenger touring car with a 120 inch wheelbase and equipped with Firestone 34 by 4 inch casings and tubes, non-skids in the rear. The motor is a V type eight with a bore of three inches and stroke of five. It was fitted with Atwater-Kent ignition and Champion spark plugs. A Ball carburetor was fed from a Carter gravity tank. Ward-Leonard starting and lighting equipment was used with a Willard 6-80 battery. This car is one of the regular stock models selling at \$1350 and was taken at random from the assembly floor at the

King factory at Detroit. It was inspected by F. E. Edwards, representing the A. A. A., and then sealed and shipped to the Sheepshead Bay speedway for the test.

The official report filed by Mr. Edwards with the A. A. A. verified the statement that the car was a regular stock model, that there was no perceptible play in any of the motor bearings, no play at such places as the roller followers of the push rods, between the push rods and their guides. The cylinder walls and pistons were in excellent condition and the wear less than .001 inch. The carbon deposit on the piston heads was slightly more than 1-16 inch thick. In this report it was revealed that the car travelled 1172.76 miles to a gallon of oil, the total quantity consumed being about 35 quarts.

Both these drivers, however, made up for their ill luck in the 50 mile race, De Palma winning the first prize, \$1,200, and Rickenbacher \$600, the second money. The time was 29:02.47 and 30:01.65 respectively. De Palma had the race in his control from the start, making a terrific pace and averaging 103.45 miles per hour for the 50 miles. Henderson in a Maxwell finished third and Lewis in a Crawford fourth.

A week later at Kansas City De Palma scored another victory on the new one and one-eighth mile dirt track, winning the 100-mile race in 1:42.54, an average of 58.68 miles an hour.

In a subsequent event held in connection with the same meet Eddie O'Donnell went through the fence and sustained a fractured arm. The accident happened on the thirteenth lap of a 25 mile free-for-all.

RESTA DRAWS NEARER BOSCH CUP.

Victory at Omaha Practically Assures Championship of 1916 to Foreign Driver.

Dario Resta in winning the second annual automobile derby at Omaha, Neb., on July 15 practically clinched the championship honors for 1916 and also the \$13,500 in money and a cup offered by the Bosch Magneto Company and the Goodrich Tire Company. Resta now has 2400 points, leading his nearest competitor, Ralph De Palma, by 730 points and Eddie Rickenbacher, who stands third, is 1630 points behind the leader to date.

The Omaha race, which was held under unfavorable conditions, the track being in poor shape and the temperature registering over 100 throughout the contest, was anything but a walkover for Resta, Mulford giving him a nip-and-tuck race up to the last few miles. The winner's time for the 150 miles was 1:30:43.88, an average of 99.02 miles per hour.

Resta pocketed \$3,000 the first prize money and Mulford, whose time was 1:31:56.24, an average of 98.39 miles an hour, received the second money, \$1,000. Following the two Peugeots came Milton in a Duesenberg, finishing in 1:32:32.25. Henderson in his Maxwell was

the only other contestant in the money, finishing in 1:40:06.27. These four drivers and Kline, Muller and Stringer were the only contestants out of 17 starters to cross the finish line.

Two bad accidents, one in which Don Columbo, Franchi's mechanic, met his death, marred the event. On the home stretch in the tenth lap Franchi's car hit one of the ruts and skidded sidewise into the wall in front of the grandstand, tearing away the fence for a distance of nearly 100 feet, and dropped to the ground. The second accident happened in the seventy-sixth lap when the Burman Special, driven by Jack Gable, rolled over several times and was badly wrecked. Both the driver and his mechanic were thrown out when the car first toppled over, but they escaped injury except for slight bruises. This is the same car in which Bobby Burman was killed at Corona last April.

Rickenbacher, who was a favorite with the 15,000 odd spectators, went out with valve trouble in the 101st mile, while De Palma soon followed with a broken valve cap.

ELGIN RACE CALLED OFF.

Plans are on foot to hold the American Speedway Grand Prize at the Chicago Speedway on August 19th, the date set for the Elgin road races. When the latter event was called off David F. Reid, president of the Speedway Park Association, asked the A. A. A. contest board for the date and a unique plan of contest is proposed. It is planned to hold five heats of 20 miles each, followed by a 50 mile final event, the winners of the heats to qualify for the finals. The heat winners, however, are not obliged to enter the finals as they are entitled to part of the prize money as there are five prizes and only five will be qualified to start in the finals. In addition to a gold cup for the American Speedway Grand Prize there will be \$10,000 in prize money to be divided as follows: \$5,000 for first, \$2,500 for second, \$1,250 for third, \$750 for fourth and \$500 for fifth. In qualifying the cars must average 100 miles an hour.

LINCOLN HIGHWAY MAPS READY

The Lincoln Highway Association, Detroit, Mich., is now prepared to handle demands for large wall maps showing the route of the transcontinental route from New York City to San Francisco, together with the main feeder and connecting roads throughout the country. The new maps are complete in every detail and every town, city and county in the United States is indicated and named.

TRANSCONTINENTAL PATHFINDER.

A Pathfinder 12 cylinder car, with all gears but high and reverse removed, is making a run from the Pacific to the Atlantic to test the flexibility and endurance of the machine. The car is following the Lincoln Highway from San Diego to New York City, the drivers being Walter A. Weidley and Heinie Scholler of the sales department of the Pathfinder Company. Two weeks after the start the car had reached Denver, Col., and was in prime condition.



The Transcontinental Pathfinder 12 Now En Route from Pacific to the Atlantic.

Motoring Clothes of Distinctive Design.



An Effective Combination of Chiffon Veil and Lace and Straw Hat with Fancy Band, the Veil Being Decidedly Practical on Dusty Roads.



A September Sport Costume Made of Plain and Striped La Jerz, a New Sport Silk in Jersey Weave which will Not Stretch—Coat in Orange with New Japanese Collar.



A Fetching Contrivance for Wet and Cold Weather to Be Worn Under the Coat to Protect the Head, Throat and Chest of the Motorist.



Dainty Model of Pale Tan La Jerz Light Weight Motor Coat—Auto Veil in Purple Shadings and There Are Little Violets in the Auto Bonnet. (Frances Clyne, Inc., New York).



Serviceable Weather Coat of Waterproofed Silk with Ripple Cape—The Full Back Makes for Grace, and Collar and Cuffs Are for Stormy Days. (Franklin Simon Co., New York).

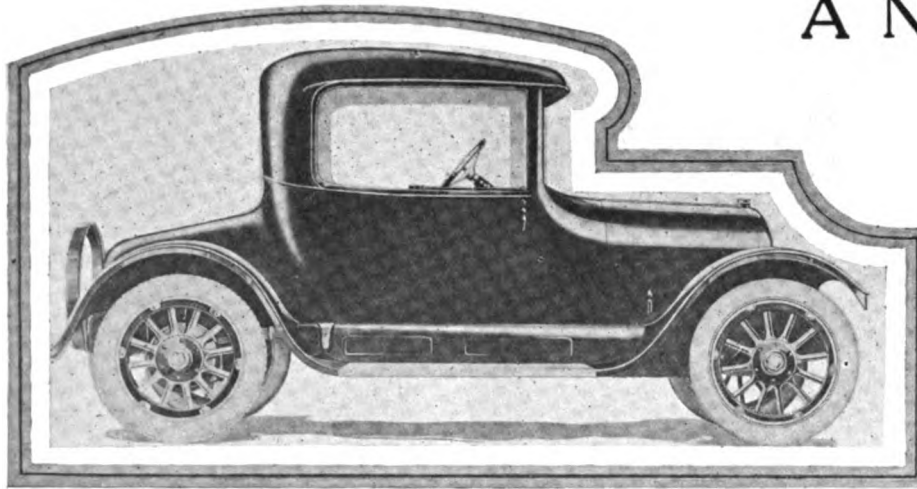
Photographs by Joel Feder, New York.



Typical English Sport Suit of Donegal Thorntweed with Mannish Lines and Belted Norfolk Coat Which Is Very Desirable for Motor Car Wear. (Abercrombie & Fitch, New York).

A New Four and a Six

Keynote of New Models Is Attention Having Been De-Production Facilities Permits



Four-Cylinder Coupe, Series 85, Priced at \$1045.

THE economy of building motor cars in large quantities and in a thoroughly modern plant is well illustrated in the latest additions to the Overland line of automobiles, which consists of a four-cylinder model selling at \$795 and a six priced at \$925. These new chassis are known as series 85, and together with the smaller Overland four, series 75-B, make up the line for 1917.

The two new cars contain all the features proven by general practise and those special details which have been so successful on former Overland models. Numbered among these is the placing of the gasoline tank with gauge at the rear of the chassis, the fuel delivery being by vacuum system to the Tillotson carburetor, which is located high on the motor and is provided with hot air attachment.

Another improvement is the adoption of cantilever rear springs, a type which has the advantage of absorbing practically all the road shock before it reaches the body, due to the fact that it is joined to the axle at the rear end instead of in the middle. The front springs are semi-elliptic. Further refinement is that the seats have been built lower and deeper and are tilted sufficiently to provide maximum comfort for the passengers. Deep coiled springs are used.

Both cars were designed and built for riding comfort. An exceptionally long wheelbase of 112 inches for the four and

116 inches for the six provides for large and comfortable bodies with ample room for seating five adults without cramping or crowding. The length of the wheelbase also adds greatly to the general appearance of the cars.

The new four is equipped with a big and powerful 35 horsepower motor of standard block design, and the same type as is being used on more than 300,000 cars in all parts of the world. It has a bore of $4\frac{1}{2}$ inches and a stroke of $4\frac{1}{2}$ inches and at normal engine speeds is capable of developing power in excess of anything needed for ordinary driving. The motor in the four is cooled by the thermo-syphon system.

The motor in the new six is cast en bloc and has a bore of $3\frac{1}{4}$ inches and a stroke of $4\frac{1}{2}$ inches, developing about 40 horsepower. Cooling is by circulating pump. The radiator is of the Overland cellular type with vertical circulation.

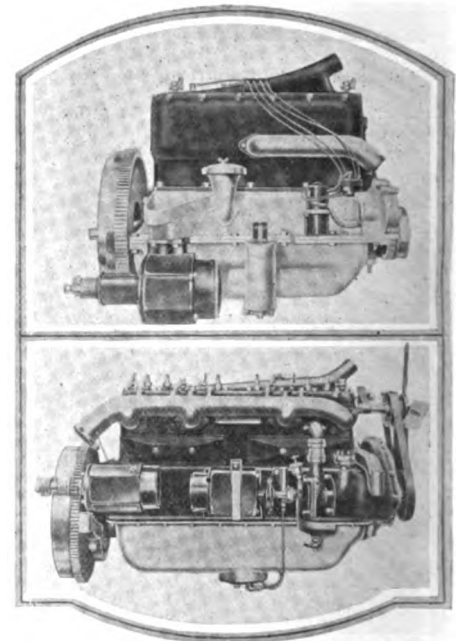
Lubrication is by the constant level splash system with geared oil pump. The oil is strained continuously and there is a float gauge on the side of the motor indicating the amount of lubricant in the crank case.

The Overland engineers have adopted battery ignition in preference to the magneto system formerly used. The ignition current is furnished direct from the storage battery, which is kept charged by the generator of the starting and light-

ing system, an arrangement that dispenses with any individual generating mechanism and is claimed to be the simplest and most satisfactory method.

For starting and lighting the Auto-Lite equipment has been retained on both the four and the six, the drive for starting purposes being to the rim of the flywheel through a Bendix drive. The equipment is a two-unit, six-volt type.

An outstanding feature of the three-speed selective transmission system is the double universal joint construction. The joint is made up of two sets of leather discs bolted at their edges to steel spiders on the ends of the driving



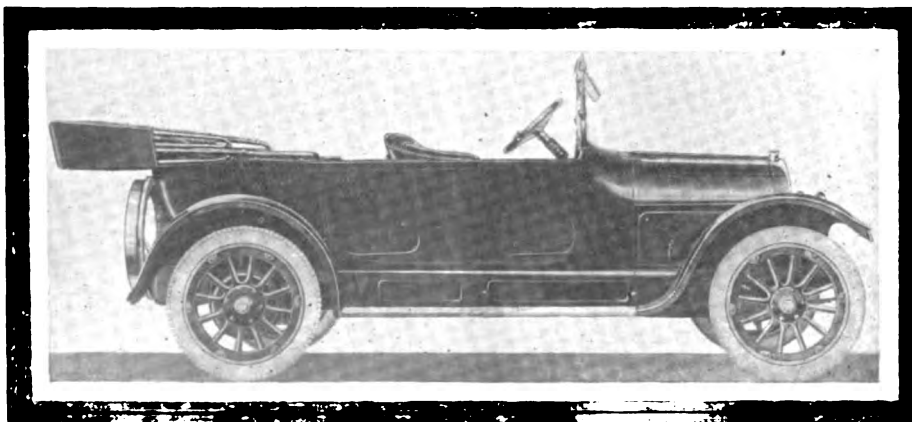
Top: Four-Cylinder Engine — Bottom: the Engine of the Six-Cylinder Model.

and driven shafts. By this means the wear consequent to the use of the metal to metal bearing surfaces is eliminated. The joint requires no lubrication and is silent in operation and provides a cushion effect that adds to the smoothness of the drive.

A leather faced cone clutch, with clutch brake to facilitate gear changing, is used on both models. The pedals of the clutch and service brakes can be adjusted to the reach most convenient for the driver.

The rear axle of the four is of the full floating type, with four bevel differential gears and removable shafts, while that of the six differs only in that it has the spiral bevel gear drive. The front axle is an I beam section, drop forged in one heat without welding.

As in all Overland models, particular



Four-Cylinder Five-Passenger Touring Car, Series 85.

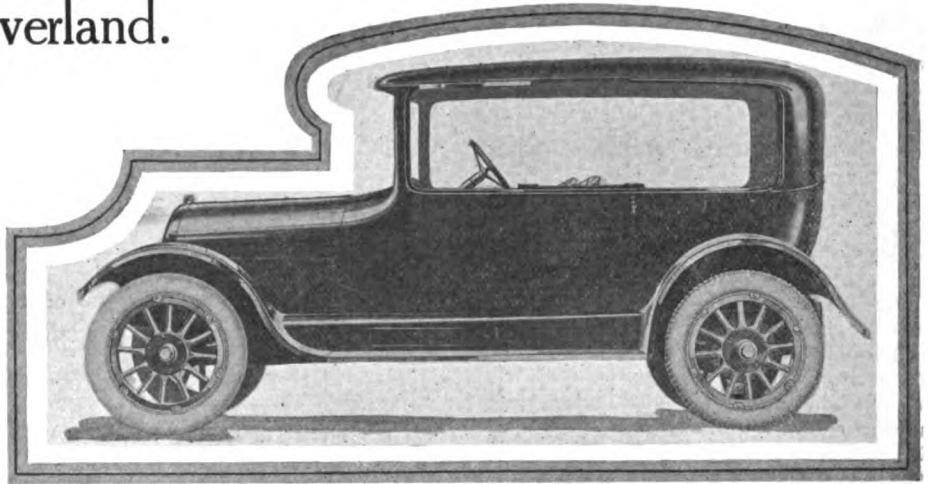
Offered By The Overland.

Power and Comfort, Much voted to Those Factors—of Very Moderate Prices.

attention has been given to the convenience of the driver. Electric control buttons for ignition, lights and horn are located in a small switch box on the steering column just below the wheel. All indicating devices are conveniently arranged on the one-piece cowl dash instrument board.

Tires are 32 by four-inch, quick detachable, with non-skid in the rear. Demountable rims are standard equipment on both models.

The bodies follow out the characteristics of design now so familiar in Overland cars. The new models are finished in dark Brewster green, with stripings of



Four-Cylinder Touring Sedan, Series 85, Price \$1195.

put through a course of instruction to teach them a quick method of identifying automobiles. This system is being put into force to enable the men to quickly recognize a machine that is being sought for participating in some evasion of the law.

The method of distinction employed is similar to that in identifying persons; that is, by their principal characteristics: Height, width, size and location of eyes, nose and ears. At first thought the similarity would not be recognized as sufficiently strong to make the methods of identification a very reliable one, but one glance at the passing automobiles on the street will show that the headlights correspond to the eyes, the fenders to the ears and the hood to the nose. Where a Renault, Franklin, Scripps-Booth and other cars with a sloping, pointed hood would be classed among those with Roman noses, the makes with the square front radiators are likened to a pug nose; flat and oval mud guards correspond with lopping and flat ears respectively. Carrying out the system extensively it forms an accurate method of identification, as no two makes of cars have all these characteristics in common, a fact which is also true of people. By the process of observation and elimination, the policeman who has learned the "ear marks" of the different makes can readily identify a car after a little practise. This course of training

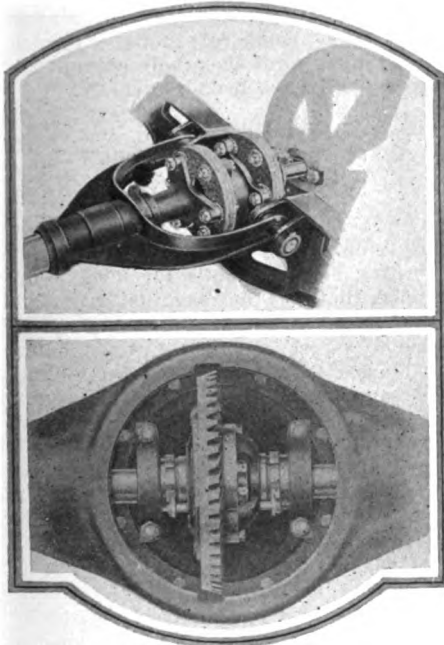
is expected to prove valuable to the police in apprehending an automobile thief before he can get out of the city, particularly as all the outposts are connected with a single alarm system over which news of a theft is quickly transmitted.

"ROADAPLANE" CROSSES COUNTRY

An Apperson "Roadaplane" was driven by Miss Claire Rochester from New York City to San Francisco, a distance of 3710 miles in nine days' driving time. This car is a new model recently brought out by the Apperson Brothers Automobile Company, Kokomo, Ind., and was the first one shipped to New York City. Approximately 252 gallons of gasoline and 33 quarts of oil were consumed on the journey, and Miss Rochester reports that she did not meet with a single mechanical difficulty nor was she required to make an adjustment.

OVERLAND AS FARM TRACTOR.

A model 30 Overland engine from a 1909 model is being used by C. G. Bonnell & Son, of Medford, Minn., in a farm tractor and the body and running gear have been made into a trailer and boat cart. The engine before being put to its new task had been run over 250,000 miles.



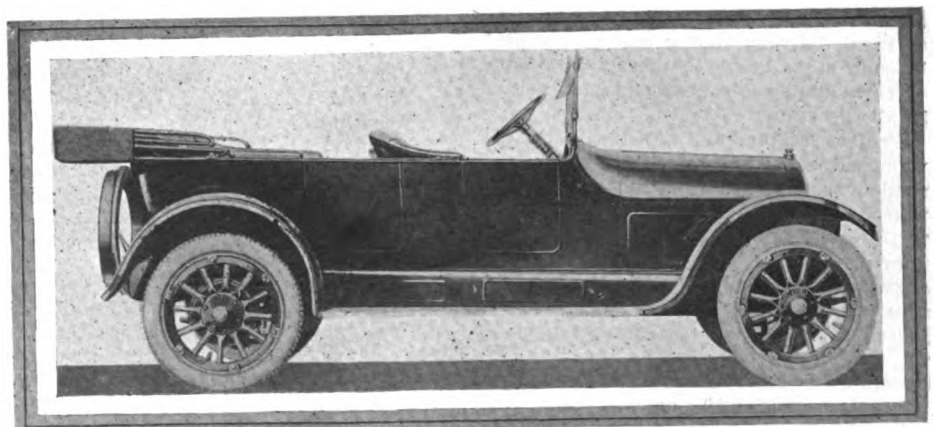
Top: Leather Universal Joint —Bottom: Bevel Gear Assembly Employed.

ivory white. The fittings are of polished nickel and aluminum, while the fenders are black enameled.

The complete equipment of the series 85 includes an Auto-Lite two-unit, six-volt, electric starting and lighting system, with head, tail and dash lamps and headlight dimmers; ammeter to register electric current; one-man mohair top and top boot; curtains fastened from the inside; built in rain vision, ventilating type windshield; magnetic speedometer; electric horn; combination tail light and license bracket; hinged robe rail; foot rest; tire carriers in rear; extra demountable rim; full set of tools; jack and pump; tire repair kit.

IDENTIFYING AUTOS.

In New York City the 250 policemen that guard its outer portals are being



Six-Cylinder Touring Car, Five Passenger, Series 85.

HUGE FUND FOR COUNTRY ROADS.

Passage of Federal Aid Bill Which Provides for Expenditure of \$85,000,000.

The passage of the Federal Aid Road Bill in Congress on July 11 makes available \$85,000,000 of government funds for the construction and improvement of rural roads. Of this amount \$10,000,000 will be set aside for work on the roads and trails within or partly within the National Forests. The larger amount will be expended under co-operative arrangements with the highway departments of the various states for the construction of rural post roads.

The funds will be distributed among the 48 states during a five-year period, \$5,000,000 being given the first year.

The act limits the Federal government's share in road work in co-operation with the states to 50 per cent. of the estimated cost of construction. Federal aid may be extended to the construction of any rural post road, excluding all streets or roads in towns having a population of 2500 or more, except the portions of such streets or roads on which the houses are, on an average, more than 200 feet apart.

Five million dollars is made available for expenditure during the fiscal year ending June 30, 1917, and thereafter the appropriation is increased at the rate of \$5,000,000 a year until 1921, when the sum provided is \$25,000,000, making a total of \$75,000,000.

The class of roads to be built and the method of construction are to be mutually agreed upon by the secretary of agriculture and the state highway departments.

The act provides that after making necessary deductions for administering its provisions—not to exceed three per cent. of the appropriation for any one fiscal year—the secretary of agriculture shall apportion the remainder of each year's appropriation in the following manner:

One-third in the ratio which the area of each state bears to the total area of all the states; one-third in the ratio which the population of each state bears to the total population of all the states; one-third in the ratio which the mileage of rural delivery routes and star routes in each state bears to the total mileage of rural delivery routes and star routes in all the states.

Project statements setting forth the proposed construction of any rural post road or roads in a state are to be submitted by the state highway department to the secretary of agriculture, and upon approval by the secretary all necessary surveys, plans, specifications and estimates must be furnished. The roads projected must be of a substantial character, and items covering engineering, inspection and unforeseen contingencies are not to exceed 10 per cent. of the total estimated cost of the work.

Upon completion of the work as approved by the secretary, the amount set

aside for the project is to be paid to the proper state official. The secretary of agriculture is given authority in his discretion to make partial payments as the work progresses, but not in excess of the Federal government's pro rata share of the labor and material which have been actually put into construction work, nor

DISTRIBUTION BY STATES.

State	Total
Alabama	\$1,608,000
Arizona	1,076,250
Arkansas	1,272,750
California	2,336,250
Colorado	1,302,000
Connecticut	478,500
Delaware	124,500
Florida	840,750
Georgia	2,079,750
Idaho	941,250
Illinois	3,432,000
Indiana	2,109,000
Iowa	2,260,500
Kansas	2,231,250
Kentucky	1,509,000
Louisiana	1,019,250
Maine	731,250
Maryland	662,250
Massachusetts	1,140,000
Michigan	2,259,750
Minnesota	2,190,750
Mississippi	1,371,000
Missouri	2,633,250
Montana	1,512,750
Nebraska	1,660,500
Nevada	1,004,250
New Hampshire.....	324,750
New Jersey.....	912,000
New Mexico.....	1,235,250
New York.....	3,877,500
North Carolina.....	1,746,000
North Dakota.....	1,176,000
Ohio	2,905,500
Oklahoma	1,773,750
Oregon	1,221,750
Pennsylvania	3,585,750
Rhode Island.....	180,750
South Carolina.....	1,111,500
South Dakota.....	1,256,250
Tennessee	1,773,750
Texas	4,515,750
Utah	869,250
Vermont	354,000
Virginia	1,530,000
Washington	1,098,750
West Virginia.....	825,750
Wisconsin	1,983,000
Wyoming	956,250
Total.....	\$75,000,000

in excess of \$10,000 per mile, exclusive of the cost of bridges of more than 20 feet clear span. All construction work is subject to the inspection and approval of the secretary of agriculture.

The various states securing aid under the provisions of the act are charged with the making of needed repairs and

the preservation of a reasonably smooth surface, considering the type of the road, but are not obligated to make extraordinary repairs or undertake reconstruction. If, after due notice, a state fails to maintain a federally aided road properly, the secretary is required to refuse further aid until the road has been properly repaired at state expense.

The sum of \$10,000,000 is made available in yearly appropriations of \$1,000,000 for the co-operative construction and maintenance of roads and trails within or partly within the national forests by the United States, states, territories, or counties in which the forests lie. Expenditures for this purpose are not to exceed 10 per cent. of the value of the timber and forage resources available for income upon the national forests where the roads or trails are constructed. Beginning with the next fiscal year after an agreement is made between the secretary of agriculture and a state, territory or county for the co-operative construction of such roads, 10 per cent. of all revenues from such forest are to be applied toward reimbursing the United States government for funds expended in road work until the whole amount advanced shall have been returned.

VISITORS IN MASSACHUSETTS.

As the result of the arrest of a New York motorist in Boston recently, for operating an automobile for hire, it developed that any automobilist from another state, excepting New Jersey, was liable to arrest immediately upon entering Massachusetts. This unusual situation came about through the failure of the highway commission of that state to ascertain what rights other states will grant Massachusetts autoists, the law, which is section three, laws of 1909, chapter 534, stating that the number of days a visiting motorist may remain in the state without getting a license cannot be determined until the highway commission has decided by conference with the law makers of the state the autoist comes from what privileges will be granted automobilists there.

OVERLAND IN MOUNTAIN TEST.

J. L. Bender, Overland dealer at Altoona, Penn., to demonstrate the power in the new series 75B Overlands, drove his car up Buckhorn mountain, one of the highest elevations in Pennsylvania, on high gear. This feat has been attempted often by private owners, but has seldom been accomplished, owing to the length and steepness of the grade. The road ascending the mountain is seven miles long and attains an altitude of 2850 feet.

Other Overland dealers in mountainous sections are giving similar demonstrations to their customers, as they are not only rather conclusive proof of the power in the car, but also of its stability and riding qualities, owing to the general poor condition of the mountain roads.

DETAILS OF THE NEW LAUREL 35.

A Moderate Priced Car with a Powerful Four Cylinder Motor Developing 36 H. P.

LIGHT weight, superior construction, high power and low upkeep cost are the main features of the new Laurel 35 four-cylinder car, made by the Laurel Motor Car Company, Richmond, Ind. With these points in mind the engineers also gave attention to cost, and have evolved a 36 horsepower machine with 112-inch wheelbase at a price of \$795.

Outstanding Features.

In general appearance the car compares favorably with much higher priced automobiles. It has a powerful motor, considering the weight of the car, and in tests has demonstrated very acceptable hill climbing ability. Comfortable riding is assured through the employment of cantilever spring suspension.

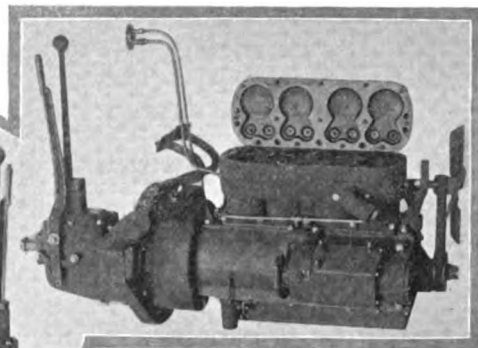
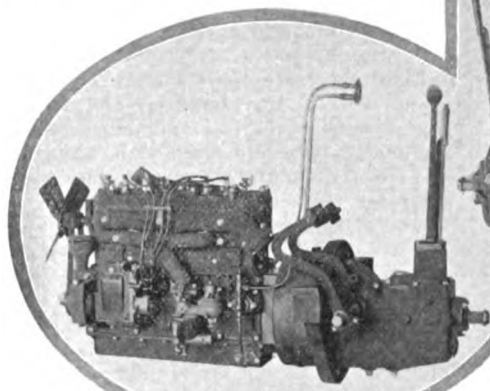
The high speed motor is a four-cylinder block casting with $3\frac{1}{4}$ -inch bore and $4\frac{1}{4}$ -inch stroke, developing 36 horsepower at 2800 revolutions per minute. The cylinder head is detachable and there is a detachable stamped steel oil pan at the bottom of the crank case that allows access to connecting rod bearings without disturbing the working parts of the motor. The three crankshaft bearings are extraordinarily large for this size motor.

The valves are extra large, having a clear opening of $1\frac{1}{2}$ inches and diameter of $1\frac{1}{16}$ inches. They are adjustable and enclosed with breather openings, which allow crank case compression to pass out of the crank case into the valve chamber and through these breathers into the cover. No oil can pass.

Lubrication System.

Lubrication is by a combination force feed and splash system with revolving sight feed on dash, to which the oil is forced by plunger pump. Sight feed is provided with the oil line leading back to the three main bearings of the motor from the oil runs into the steel tray, where scoops splash a generous supply at all times. The oil runs by gravity into the main oil tank where it is filtered through a fine mesh screen and again pumped to the sight feed on the dash. Cooling is by thermo-syphon system with radiator of flat and cellular appearance.

Ignition is by Dixie high tension magneto, while electric starting and lighting is by the Disco System, with 12-volt storage battery, which also supplies current for the headlights, equipped with dimming



The Laurel Power Plant.

device, tail light and cowl light upon the instrument board.

The power plant is a unit, including motor, clutch and transmission gearset. The clutch is a single steel drive plate, having two asbestos wire woven friction discs, running in a bath of oil. The transmission is the conventional three-speed selective type with centre control and can be removed without disturbing the installation of the motor. S. K. F. bearings are used. Drive to the rear axle is by the full Hotchkiss system, with two universal joints and spring suspended torque truss.

Rear Assembly.

The rear axle is a full floating type, locked in the wheel hubs with a six-dog clutch. The differential connection on the axle is by six splines. A nickel steel pinion carries Gurney bearings, Salisbury bearings are in the differential and two Bower bearings in each rear wheel hub. The front axle is an I beam drop forging with ball bearings in the wheels.

The rear springs are full cantilever and front springs are semi-elliptic. The main leaves are made of vanadium steel. Drive is from the left hand side, while control is centred, with ignition and light switch buttons on the instrument board.

The body is of the approved full stream line design with ample room for occupants. All four doors have pockets and there is large storage space under the rear seat. The wide crowned fenders are of heavy material and have graceful curves.

Standard equipment includes the latest design of one-man mohair top in which the curtains are rolled and suspended from the inside; adjustable two-piece rain vision windshield; Goodyear tires, 30 by $3\frac{1}{2}$, non-skid on the rear; demountable rims, one extra; tire carrier on the rear; speedometer; electric horn; jack; full kit of tools; tire repair kit; top boot.

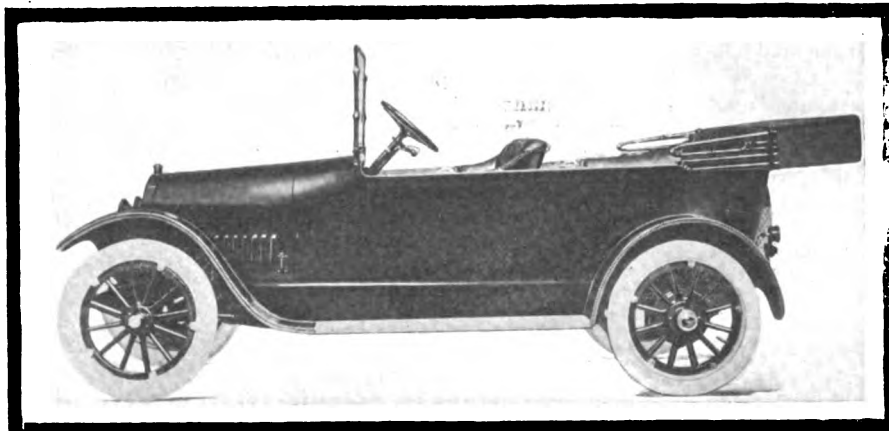
UNIQUE OIL SERVICE.

A unique service to users of lubricating oils is being offered by the Viscosity Oil Company, which is endeavoring to make the consumer realize the necessity of getting the proper grade of lubricant for his particular requirements. Basing its policy on the fact that, in order to secure the highest point of efficiency from lubrication oils a study of their application is necessary, the Viscosity company has secured a staff of representatives all of whom are economy engineers. They are always ready to make a thorough study of the application of oils and the conditions peculiar to the situation. The expert who makes the survey, the chemist, and if possible the user, are called together in a conference where every detail is thoroughly considered and every problem carefully studied.

Then the chemist from the data on hand, together with the knowledge and combined advice and suggestions of those who know the conditions—makes up a formula for the oil that is best suited to the conditions under which the machines must work. This formula is completed and tested until the most efficient combination is secured.

Among the biggest items in the upkeep of a motor are worn pistons, piston rings and carboned cylinders. These are due almost entirely to improper lubrication. The ordinary heat of a motor is estimated at 350 degrees. Many oils carbonize as low as 365 degrees, giving a margin of only 15 degrees.

Visco motor oil does not carbonize until the tempera-



The Laurel Model 35 Touring Car, Priced at \$795.

ture reaches 460 degrees—a margin of safety of 110 degrees over the ordinary heat of a motor.

"H. A. L. TWELVES."

The "H. A. L. Twelve," recently put on the market by the H. A. Lozier Company of Cleveland, O., has a number of unique features which are in marked contrast with the cars of its class already on the market. Aside from the motor, which is of the valve-in-the-head type, the design is interesting on account of the long wheel base (135 inches) and light weight. A specially designed spring suspension, it is claimed, gives it riding qualities that cannot be obtained ordinarily without an extremely heavy chassis. The long frame makes possible a commodious body for seven passengers designed particularly for the comfort of the occupants.

AUTO FEES FOR ROAD BUILDING.

\$16,213,387 of Auto Money Paid for Highway Construction During 1915.

Ninety per cent. of the registration and license fees paid in 1915 by automobilists to the states, or \$16,213,387, was spent for the building and maintenance of county and state roads, according to a compilation published by the Office of Public Roads, United States Department of Agriculture. In all, 2,445,664 motor vehicles were registered in that year and their owners paid a total of \$18,245,713 for registrations and drivers' and dealers' licenses. This is an increase of \$5,863,760 over 1914, and an increase of 734,325 in the number of vehicles registered. Automobile fees now defray nearly seven per cent. of the total amount spent on rural road and bridge building, whereas in 1906 the income from this source was less than three-tenths of one per cent. of the total expenditure.

The growth of the volume of fees and registrations is noted by the fact that in 1901 New York, the first state to require fees, collected only \$954. In 1906 only 48,000 cars were registered throughout the entire United States. By 1915, however, the number had jumped to the figure given, so that there is slightly more than one motor car registered for each of the 2,375,000 miles of road outside of the incorporated towns and cities.

The relation between cars and road mileage varies widely in different sections. There was only one motor car for every six miles of rural road in Nevada, but nearly six motor cars for every mile of such road in New Jersey. There was an average of one motor car registration for every 44 persons in the United States. Iowa apparently led, however, with one motor car for every 16 persons, while only one for every 200 persons was registered for Alabama.

It must be understood, however, that the figures of registration do not necessarily represent a total number of cars,

CLOSING DATE OF CONTEST.

The Haynes Automobile Company, Kokomo, Ind., will at midnight of August 19 close entries to its offer to exchange a Light Twelve automobile for the oldest Haynes car. One hundred and thirty-five owners of the two and four cylinder models, built many years ago, have answered the inquiry of the Haynes company for the oldest car.

One of the entries is an old two cylinder car that was built in 1897. It weighs about 1950 pounds and cost \$1950. It is a surrey type that provides room for four passengers and is steered by a lever, the warning signal, a bell, being operated by a foot lever. The car can make 15 to 20 miles an hour over good roads. Its engine has a 5 inch bore and 6½ inch stroke and is rated at 15 horsepower. It is owned by W. F. Smith, Bound Brook, N. J.

as some of the states do not require annual registration, others group pleasure and commercial cars and motorcycles in their accounts, while still other states do not require registration of motorcycles.

There is great inequality in the registration fees charged by the different states. The average for the United States was \$7.46. The State of Vermont, however, secured in 1915 a gross revenue of \$18.10 for each motor car, while Minnesota received only about 50 cents annually for each car. In Texas and South Carolina no annual registration fees are collected, the only requirement being a county fee of 50 cents and \$1 respectively for perennial registration. Most of the states, however, also levy annual taxes on motor vehicles and this adds importantly to the public revenue contributed by the owners of motor propelled vehicles.

In the use of fees, however, there seems to be a general policy of applying the major part of the money collected from the automobilists directly to road betterment. In 42 of the states of the Union all or the major portion of the motor vehicle revenue must be expended for the construction, improvement or maintenance of the public roads, or for the maintenance of the state highway department. In 20 states all or the major portion of the net motor vehicle revenues are expended by or under the supervision or direction of the State Highway Department. In seven states one-half to one-fourth of the state motor vehicle revenues are expended through the State Highway Department, and the remainder by the local authorities.

BLIND SPOT CAUSES ACCIDENTS.

The circumstances surrounding many

automobile collisions are inexplicable. When the witnesses of such accidents get into court quite often one will testify to seeing something on the road, while another will testify that there was no such object present. The explanation of these queer pranks on the powers of observation seems to have been found in the discovery that in everybody's eyes there is a normal blind spot, which accounts for the fact that absolutely void or vacant areas as large about as 25 square feet and spaces six feet high and nearly five feet wide in the broadest part, may appear to a person travelling in a rapidly moving vehicle of any kind.

This blind spot is in the place of the seeing part of the eye where the optic nerve centres. Dr. Leonard Keene Hirschberg of John Hopkins university in writing on the subject says: "It is so large in focus that the head of a man or even the head of an eagle or cat at a distance of six feet or so will fall upon it and will be absolutely unseen."

The danger of accidents due to this defect in the vision can largely be avoided by keeping the eyes more in motion when driving an automobile than is usually the custom. Just a small movement of the eyes would bring the possibly unseen areas into the seeing parts of the eye.

WOODS MOBILETTE.

"The Greatest of All Tests" is a book just issued by the Woods Mobilette Company of Chicago, Ill., manufacturers of the Woods Mobilette. The book is unique. It is made up entirely of testimonials from users of the car, these letters indicating that the owners, in addition to being enthusiastic over the little car, have found it extremely economical in operation, securing large mileage per gallon of gasoline and also on tires. They also come from men in varied lines of business and show that the Woods Mobilette has been tested out in every climate and under all kinds of weather and road conditions.

MOTOR CARS IN PANAMA.

Consul General Alban G. Snyder at Panama, in writing of motor car conditions in that country, says that comparatively few citizens are able to purchase and maintain cars. There are 401 cars registered there, including pleasure and commercial vehicles and cars registered in the canal zone. Only a few high priced cars are in use, the demand being mainly for low priced machines. There are no electrically operated machines in Panama and there is no demand for them.

COLE HEADS INDIANA S. A. E.

J. J. Cole, president of the Cole Motor Car Company, Indianapolis, has been elected chairman of the Indiana Section of the S. A. E. Mr. Cole has a reputation of being a tireless worker for any cause in which he is interested and it is expected that the Indiana section will develop many important matters.

The Allen Classic

Something Different

to meet
Your
Demand

—and
CLASSIC is the name of
all names for this
truly distinctive car.

Find, if you can, more
beauty of line and finish
than is embodied in this
aristocrat of cars, as
faithfully illustrated on
the next two pages.

There are discriminating
buyers in your town who
will be delighted with this
masterpiece of automo-
bile design and finish—
a combination which has
no equal.

\$850

F.O.B.
FOSTORIA,
OHIO.

The Allen Motor Co.



The Allen Classic

A handsome, distinctively finished, well built motor car

"Beautiful"—with emphasis. That's what everybody say when they see this car.

And then, when they have finished admiring its *outward* appearance, they find equal satisfaction in its mechanical construction and performance.

While the Allen Classic was primarily designed with an idea of producing a strikingly handsome car, at the same time bear in mind that in this instance, beauty is more than skin deep.

The same chassis, the same powerful motor, the same long underslung rear springs, the same simplicity and sturdiness that have made an enviable name for the Allen 37, are embodied in the Allen Classic.



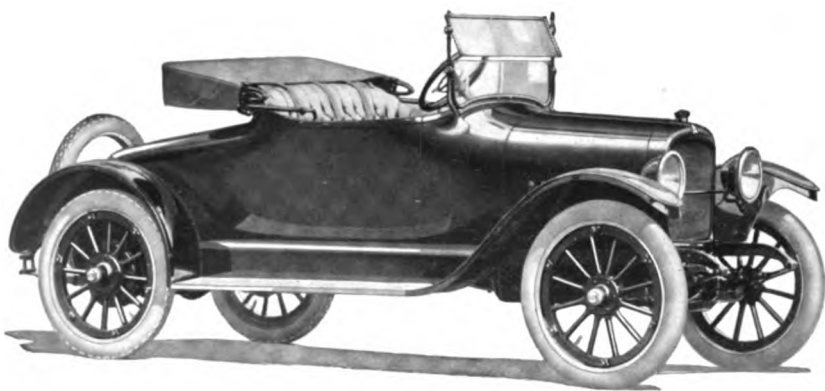
Beautiful, comfortable, efficient
The height of motor car value

F. O. B. **\$850**
Fostoria, Ohio

While beauty in a motor car is a great source of satisfaction, it cannot be complete unless there be an abundance of comfort and uninterrupted service.

And in *these* days, to have comfort it is not necessary to buy high-priced cars. Scientific balancing of parts, proper spring suspension, correct body building and upholstering, have most to do with comfort.

In the Allen Classic you find these essentials combined in an unusually efficient manner, with the result that comfort is a big part of the value in this splendid car.



The Allen Classic Roadster

Low-priced roadsters with good body lines are few. Just a glance at the Classic Roadster is sufficient to establish it as a car sure to find favor among professional men and others to whom a good roadster is a necessity.

The gracefully curved rear deck is provided with a long door hung with concealed hinges and flush water-proof joints, giving an unusually neat appearance. The compartment has plenty of room for two or three extra casings or suit cases.

Summing it all up the Allen Classic possesses in full measure: Distinctive beauty, abundant power, unusual comfort, ample room, exceptional economy, light weight, sturdiness and durability, and is backed by a strongly financed company of twenty-five years' standing and high credit rating.

The Allen Classic is now being delivered to Allen dealers throughout the country. Due to our recent big increase in production, there is an opportunity for a few more live dealers to secure the Allen line where it is not already represented.

The Allen Motor Company
407 Allen Bldg., Fostoria, Ohio, U. S. A.

High Spots

in the
**Allen Classic
Specifications**

Powerful four-cylinder motor, cast enbloc, $3\frac{3}{4}$ x 5 inches, 37 H. P.

Two-unit electric system for starting, lighting and ignition

Easy working clutch, smooth in action

Over-size bearings throughout

All moving parts enclosed
55-inch underslung rear springs

Full floating pressed steel rear axle

112-inch wheel base

Boat-shaped body with ample leg room front and rear

Spanish brown upholstery

Smoke brown finish on body, hood and wheels; fine gold striping.

This smoke brown finish is not only exceedingly beautiful and distinctive, but very practical, as it does not show dust and dirt as readily as the darker colors.

Leak-proof top material
32 x $3\frac{1}{2}$ -inch tires non-skid in rear

Weight, 2300 pounds

Equipment, high grade and complete

Send for complete literature on this and other models



PREVENTING HEADLIGHT GLARE.

Headlight glare should be entirely eliminated, not only because some states have regulations to this effect, but chiefly for the sake of safety. The glaring and blinding rays are those which are cast upwards from the lights and are of no benefit to the driver. There are many devices on the market which are within the means of any motorist for the accomplishing of this end, but in the event that any of these are not readily obtainable an effective method for eliminating the upward cast rays is to apply bon-ami metal polish, or some similar preparation, to the inner side of the lens. With a little care a design similar to the one shown in Fig. 202 can be formed on the glass, thus affording an effective glare eliminator.

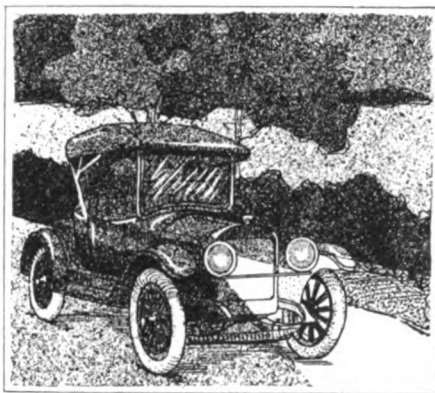


Fig. 202—A Simple and Effective Means of Eliminating the Glare from Headlights.

DEMOUNTABLE RIM REPAIR.

When the lugs on the wheel are not kept properly adjusted, depressions are worn in the demountable rim, which will become loose and noisy. A remedy for this condition is shown in Fig. 203. At the points of wear the metal should be filed away to produce a flat surface. Small pieces of brass can be soldered to the rim and then filed to an even surface.

PROTECTING CELLULOID.

Some pleasure cars and many commercial vehicles are not equipped with glass windshields, but are fitted with a curtain having a celluloid window. For the purpose of obtaining a clear vision at night and in stormy weather, it appears to be the custom for many drivers to cut a small opening.

Unless the greatest care is exercised in cutting these holes, the material is apt to tear easily, especially when rolled up and fastened to the top. Some fit a leather binding around the edges of the aperture and cement it to the celluloid. Another method is to cut a ring shaped strip of celluloid and attach it around the opening. This is accomplished by preparing a solution consisting of one dram of fine shredded celluloid dissolved in two ounces of acetate of amyl. This will produce a thick, sirupy mixture and should be applied with a camel's hair brush. Thoroughly clean the material to be joined. Allow the parts to dry for several hours before using.

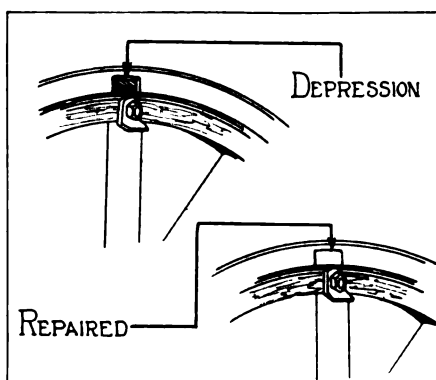


Fig. 203—Demountable Rim Repair, the Top Sketch Illustrating the Worn Part and the Bottom View the Repair.

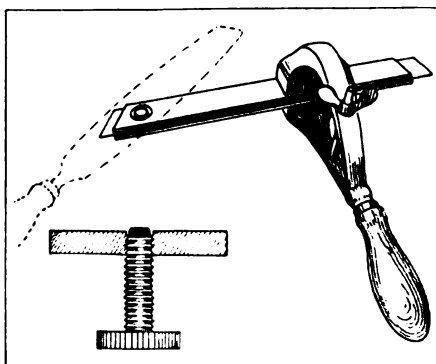


Fig. 204—A Home Made Set of Simple Jigs for Cleaning Platinum Points Quickly and Accurately.

CARE OF PLATINUM POINTS.

Although the design of the interrupter in the battery ignition system as fitted to the modern car is very much improved, it is inevitable that, after considerable use, some wear will take place, requiring a new adjustment to be made. At this time it is well to clean the points before resetting the adjustment, as these become more or less oxidized and fused from the heat of the small arc, which occurs when the circuit is broken, and also may wear slightly so that the surfaces are no longer flat.

In cleaning these surfaces with a very smooth file it is essential not only to work down to clean metal, but to true them up, so that the surface of the point on the adjusting screw is a perfect plane and perpendicular to the axis of the screw, and the rivet on the interrupter blade is a plane parallel to the surface of the blade. It is practically impossible to accomplish this if it is attempted to file the points while holding the parts in the hand.

A set of simple "jigs" can be devised so that the job of cleaning the points can be done accurately and quickly. These are very easily made and the method of their use will be understood from the accompanying sketch in Fig. 204.

The jig for the screw consists simply of a piece of brass or steel through which a hole has been drilled and tapped, the pitch of thread being the same as that of the screw. The screw is inserted in this so that the surface of the platinum point projects slightly above the surface of the jig, and the platinum is then filed down till it is flush with the latter. The jig may then be laid on a piece of very fine emery cloth and a very smooth, polished finish worked up on the point.

For the blade two strips of thin metal are used, between which the blade is clamped with a hand vice. Holes are drilled through these to accommodate the rivet, and the top strip should have the same thickness to which it is desired to dress down the platinum rivet. To determine what this thickness should be the height of the rivet should be gauged and then some allowance made for "finish," the amount of this allowance depending on how badly the rivet is pitted, or worn off to one side.

SUBSTITUTE FOR PIT.

The sketch in Fig. 205 illustrates a method in which the rear end, transmission, or other parts that are difficult of access without a pit may be conveniently got at by means of an inclined runway. In some respects placing the car in such a position makes the work easier than when placed over a pit. Better light and ventilation are afforded, especially if the work is done out doors, and if it is necessary to get from under the car several times it is easier, with this arrangement, than to climb out of a pit.

Instead of the horses shown, the planks may be laid on the steps of a horse, on a work bench, or any other convenient structure, having sufficient strength to support half the weight of the car. If the planks bend unduly it may be necessary to shore up in the middle with wood blocks, bricks or smaller horses. The car may be run up the incline in low speed, if it is desired to work under the engine, or in reverse to get at the rear end, due precaution being taken, of course, to keep it from running off the planks, and to properly secure it by chocking the wheels.

PATCHING INNER TUBES.

A garage man who has had much experience in placing cold patches on inner tubes, offers the suggestion that the cause for much failure when making this repair is that the injured section is usually placed on a flat surface. As the tube is circular in shape there is a tendency for the patch to pull off when the tube is inflated. In Fig. 206 is shown the type of stand used by this garage man. It consists of a piece of round wood about four inches in diameter and one foot in length. Nothing is better for this purpose than the thick section of a baseball bat. One side of the wood is flattened and attached to a bracket which is formed as shown. The end of the bracket is secured in a vise and the rounded table is ready for use.

USEFUL CEMENTS.

Broken celluloid articles can be mended by using a mixture of three parts alcohol and four parts of ether. Preserve this in a well corked bottle. Paint the broken edges of the celluloid to be repaired until the material softens. The parts are then firmly pressed together and the pressure allowed to remain on them for at least 24 hours.

A suitable cement for hard rubber articles is made by dissolving one part of gum camphor in four parts of alcohol. To this solution add an equal weight of shellac. The cement is applied warm and it should not be disturbed until thoroughly hard. Another method is to melt together equal parts of gutta percha and asphaltum. This mixture is applied while hot and the parts are pressed together while cooling.

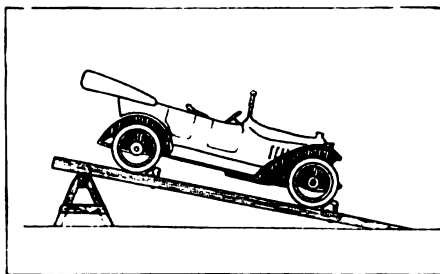


Fig. 205—Substitute for a Pit Providing Means for Getting at the Underneath Parts of a Car.

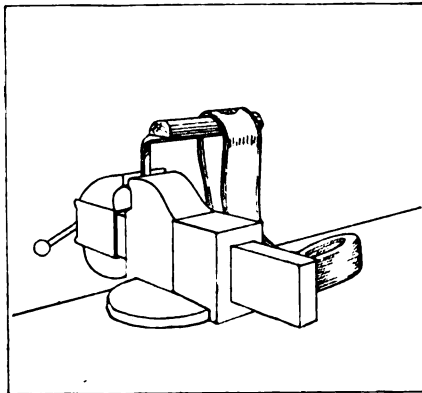


Fig. 206—Patching Inner Tubes, a Practical Device which Affords Excellent Tube Repairs by Offering a Round Surface.

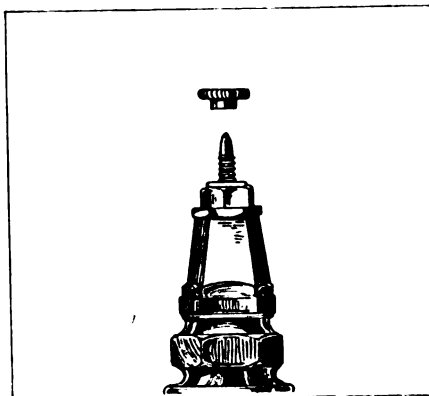


Fig. 207—A Spark Plug Suggestion Which Will Be Appreciated by Every Motorist, Particularly in the Winter Time.

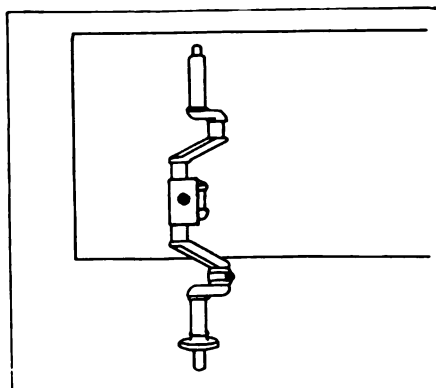


Fig. 208—Crankshaft Retainer Suggestion for Holding the Shaft Securely on the Work Bench When Working on Journals.

SPARK PLUG HINT.

A skipping spark plug is one of the most frequent of road troubles. After the faulty plug has been repaired or a new one installed, it is not a simple matter to fit the small nut on the fine threads of the electrode if gloves are worn. A reader offers the suggestion shown in Fig. 207, for facilitating this operation. It consists of filing away two or three of the top threads of the electrode so that the nut can be slipped on before attempting to catch the fine threads. This method prevents the dropping of the nut into the pan, where it is usually not easily recovered.

CRANKSHAFT RETAINER.

When the crankshaft journals become scored or cut in any manner it will be necessary to remove the crankshaft from the car so that they can be made smooth. This work is generally accomplished by placing the crankshaft in a lathe and holding a lapping tool on the damaged part. However, if a lathe is not available, the work may be done as shown in Fig. 208. The device consists of a strong bolt which passes through and near the edge of the work bench and a small piece of hard wood. With the crankshaft clamped in this manner the lapping tool may be turned by hand around the stationary journal. This method may also be adopted when scraping in connecting rod bearings.

INTERCHANGEABLE TIRES.

A large number of experienced motorists have not the slightest conception of the interchangeable tire sizes, and frequently an operator will struggle for hours attempting to mount a tire on a rim for which it was not intended. The following table shows the interchangeable sizes and includes data which is adapted to the majority of cars.

Tire Size		Tire Size
29x3 1/2	interchangeable with	28x3
31x3 1/2	interchangeable with	30x3
31x4	interchangeable with	30x3 1/2
33x4	interchangeable with	32x3 1/2
35x4	interchangeable with	34x3 1/2
37x4	interchangeable with	36x3 1/2
35x4 1/2	interchangeable with	34x4
37x4 1/2	interchangeable with	36x4
35x5	interchangeable with	34x4 1/2
37x5	interchangeable with	36x4 1/2
39x5	interchangeable with	38x4 1/2
37x6	interchangeable with	36x5 1/2

It will be noticed that the diameter of the standard sizes is always expressed in even numbers, while the oversizes are always odd numbers.

CLEANING OUT RADIATOR.

An experienced repair man advises that one of the best methods for cleaning out the radiator and cooling system of the car is by the use of sal ammoniac solution. He states that it will remove all incrustations. Allow the fluid to remain in the system and operate the car for a few days, after which flush the system with clean water.

CARTER AUTOMATIC GRAVITY TANK

A Fuel Feed System Which Does Not Depend Upon Motor Suction In Intake Manifold.

IN connection with the King Company's Car Owners Service Test, in which a stock King Eight was run continuously for two weeks, covering a mileage of nearly 11,000 miles, staticians and mechanical experts have brought out some astonishing facts and figures. One of these revelations was in regard to the

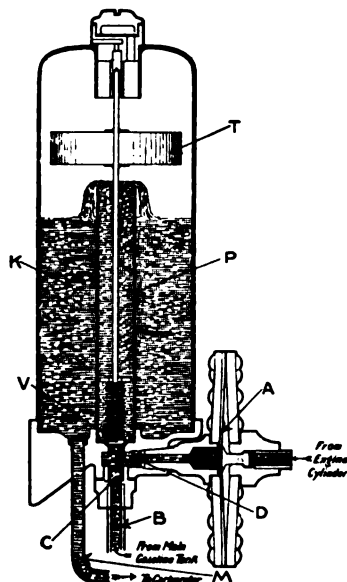


Diagram of Improved Carter Automatic Gravity Tank.

Carter automatic gravity tank with which the car was equipped and which served without the slightest interruption to the fuel feed. The diaphragm pump, which is the only important moving part of the Carter system, sustained 28,000-000 impulses during the test, or at the rate of 3700 impulses to the minute.

The Carter system differs from conventional fuel feed systems in that it does not depend for its action upon motor suction in the intake manifold, but literally pumps the fuel from the main tank in the rear to the auxiliary tank under the hood.

On each suction and compression stroke of the cylinder to which the tank is attached a simply constructed diaphragm pump lifts the fuel from the main tank to the automatic gravity tank whence it flows to the carburetor. The tank does not vary in size with the size and capacity of the motor for it is practically unlimited in capacity, furnishing several times the amount of fuel required by even the largest tractors and fire engines. The tank chamber holds slightly more than one pint of fuel.

The accompanying line sketch shows the improved Carter system. The diaphragm pump, which is indicated by A, on each suction and compression stroke of the cylinder to which it is attached makes one impulse, thereby giving two impulses to every four cycles. The movement of the diaphragm toward the cylinder causes fuel to be drawn from the

main tank through pipe B and check valve C into chamber D. Check valve C lifts and permits fuel to pass on the suction stroke but blocks the passage on the compression stroke of the diaphragm and the fuel in chamber D is then forced past valve V up the standpipe P and overflowing at the top drops to chamber K, from which it feeds to the carburetor by gravity through pipe M. Should the tank become full, the float T is raised sufficiently to open valve V and this causes the pump action to cease. No more fuel is forced through the standpipe until the float is lowered. The total variation of the float level while the engine is running is never more than one eighth of an inch.

The latest improvement of the Carter company in diaphragm construction is a laminated diaphragm in which the laminations decrease in diameter outwardly from the centre, like a leaf-spring, distributing the stress evenly over the surface of the diaphragm and multiplying itself many times. The centre lamination is of Siegelite, a vegetable fibre not only impervious to gasoline, water, oil, acid or any other element with which it may come in contact, but free from a tendency to crystallization.

COMING EVENTS

August.

Demonstration (farm tractors), St. Louis, Mo.....July 31-Aug. 4
Race (track), Tacoma, Wash.....Aug. 5
Demonstration (farm tractors), Fremont, Neb.....Aug. 7-11
Race (track), Kalamazoo.....Aug. 11-12
Hill Climb, Pikes Peak.....Aug. 11-12
Race (track), Portland, Ore.....Aug. 12
Demonstration (farm tractors), Cedar Rapids, Ia.....Aug. 14-18
Demonstration (farm tractors), Bloomington, Ill.....Aug. 21-25
Race (track), Kalamazoo.....Aug. 26

September.

Show, Columbus, O.....Sept. 2-9
Race (track), Elmira, N. Y.....Sept. 4
Race (speedway), Des Moines...Sept. 4
Race (speedway), Indianapolis...Sept. 4
Race (track), Spokane, Wash...Sept. 4-5
Demonstration (farm tractors), Madison, Wis.....Sept. 4-8
Show, Hartford, Ct., Fair Ass'n. Sept. 4-8
Show, Milwaukee.....Sept. 11-16
Race (speedway), Providence...Sept. 16
Race (track), Trenton, N. J.....Sept. 29
Race (speedway), New York, Sheepshead Bay Speedway.....Sept. 30

October.

Convention, National Association Automobile Accessory Jobbers, St. Louis.....Oct. 2-5

Race (speedway), Omaha, Neb...Oct. 7
Race (speedway), Philadelphia...Oct. 7
Race (speedway), Chicago.....Oct. 14
Race (speedway), Indianapolis...Oct. 19
Race (track), Kalamazoo, Mich...Oct. 21

January, 1917.

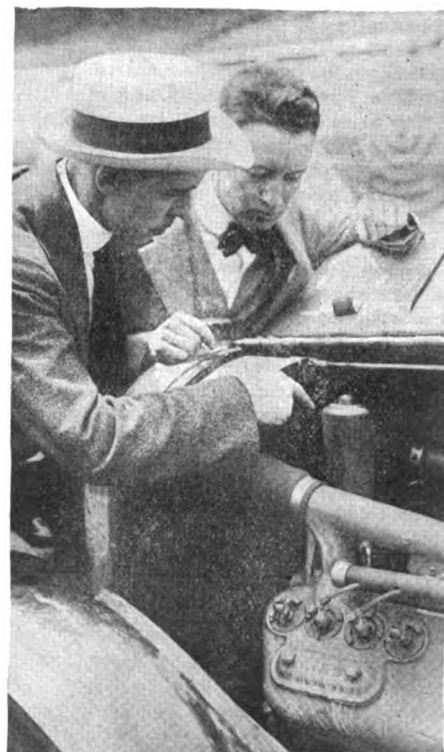
Show, New York City.....Jan. 6-13
Show, Chicago.....Jan. 27-Feb. 3

ALLEN ANNOUNCES SPECIAL CAR.

The Allen Motor Company, Fostoria, O., has announced its intention to build a specially finished car. It will be known as the Allen "Classic" and will be mounted on the standard Allen chassis. The body will be finished in a beautiful and practical shade of brown with delicate gold striping, black fenders and radiator. The upholstery will be in Spanish brown to harmonize with the body finish. A top of leak proof material completes the special "job," which is priced at \$850. The offering of the Allen "Classic" will in no way interfere with the increased production of the Allen 37 selling at \$795.

R. I. LICENSES IN CANADA.

Notification has been issued by the government of the Province of Ontario, Canada, that no special courtesies will be extended to Rhode Island automobilists and that the use of Rhode Island licenses will not be permitted on the Canadian side of the border. An offer of reciprocal automobile agreement was sent by the Canadian officials to Rhode Island, but it was found that the latter's laws are so worded that Rhode Island could enter into such agreements with states and territories of the United States but not with foreign states and provinces.



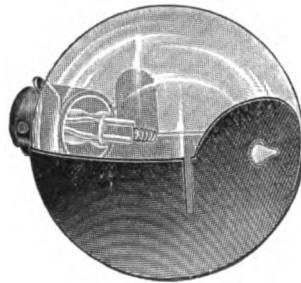
The Usual Location of the Carter Gravity Tank.

USEFUL ACCESSORIES FOR MOTOR CAR OPERATORS.

LENNON LIGHT PROTECTOR.

The Lennon light protector is a patented, flexible brass reflector, heavily plated, which throws the beams of light on the road at the approved height from the ground and stops the glare which is prohibited by statute in many states. It is made in two sizes and will fit any headlight. The protectors are light in weight and simple of construction and have no delicate springs or extra parts to become broken. They are attached without removing the bulb from the headlight, the operation being to place the eyelet of the protector over the tip of the bulb and pressing it into position, where it is held firmly. Those rays of light that ordinarily would be thrown outward and upward into the eyes of oncoming motorists and pedestrians are reversed and directed downwardly to approximately the waistline of a standing adult person.

Distributed by J. H. Faw, Inc., 41 Warren street, New York City. Retail price per pair \$1.



Lennon Light Protector, the View at the Top Showing Light Projection and Below the Protector.

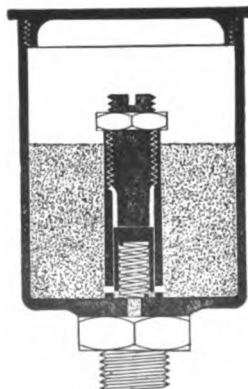
terial is packed in tubes and when coated on the work hardens in the air, or in cold or boiling hot water. Heat or acids are not required in the operation. This substance is adapted to all kinds of mending, in fact, the manufacturer states that it will "mend anything but a broken reputation."

Manufactured by the Sole Manufacturing Company, 148 Chambers street, New York City. Write for circular describing the range of repairs possible.

GRAPHITE LUBRICATOR.

The graphite lubricator is a small device which automatically feeds dry graphite to the motor cylinders, in this way allowing them to become coated with a thin film of this lubricant. The lubricator is in the form of a container which is screwed into the intake manifold. Motor suction draws in a small amount of graphite through a valve in the device. The maker declares that the device makes for better compression, increase of power, saving in fuel and oil and that it does away with the evils of carbonization.

Manufactured by the Graphite Lubricator Company, 326 Diamond street, Pittsburg, Penn. Price \$6.



Graphite Lubricator.

SPRING COVER AND LUBRICATOR.

The Woodworth spring cover and lubricator is a felt lined leather covering which is laced over the springs, entirely covering them. Before being put on the felt lining is saturated with oil, it holding sufficient to lubricate the springs for at least 10,000 miles of running. The leather is treated by a special process which makes it oil and water proof. The cover makes a very neat appearance on any car, it being laced on smoothly and tightly over the springs. It prevents dust and grit from lodging in the springs, which insures longevity of service.

Manufactured by the Leather Tire Goods Company, Niagara Falls, N. Y. Full details and prices supplied by the maker upon request.

RUNNING GEAR ALIGNER.

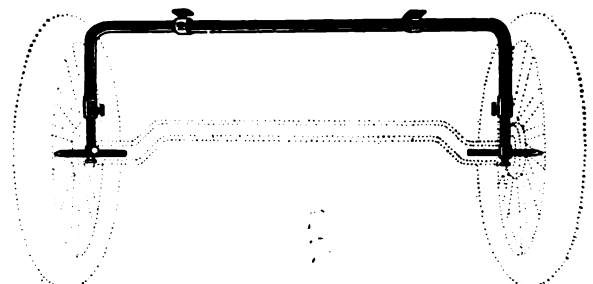
It is often admitted that the tires are the largest expense in the maintenance of a car, therefore, any means which will assist in reducing this item should be of interest to the motoring public. Besides this, the pleasures of motoring are largely measured by their condition. One of the chief causes of excessive tire wear is the incorrect alignment of the front wheels. One of the best instruments made for determining this condition is the auto running gear aligner, shown in the accompanying illustration. It is a tool of precision by which can be ascertained instantly whether the front wheels are in true alignment.

Manufactured by the Mechanical Utilities Corporation, 5 No. La Salle street, Chicago, Ill. List price, \$12.50. Write for descriptive circular.

AUTO LOCKING DEVICE.

Among the automobile locks on the market, one which should appeal to every motorist, both because of design, construction and price, is Sturr's auto locking device, two types of which are illustrated herewith. The one shown in the upper sketch is designed especially for Ford cars. It fits tightly over the gas and spark levers, making it impossible to operate the machine until removed.

The lower illustration shows the locking device, which is adjustable to all automobiles except the Ford. As shown, it fits tightly over the gas and spark throttle levers and a rib of the steering



Running Gear Aligner.

SANDBO RADIUS ROD.

The accompanying illustration shows the Sandbo radius rod, which makes for ease in steering a Ford car. This device can be attached in five minutes. It has no springs and there is nothing about its construction to get out of order. It is guaranteed for the life of the car.

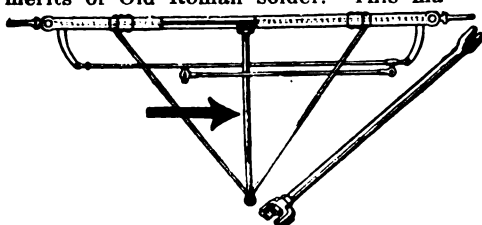
Locking the wheels is prevented by the use of the Sandbo radius rod and this attachment also prevents turning in at the axles. It keeps the front axle from tilting backward and with the proper adjustments it takes up all looseness and rattle.

The Sandbo makes the entire front end of a Ford steer firmly and steadily. It fits in the radius rod crotch to the middle of the front axle and can be adjusted to suit the driver. The Sandbo is covered by a liberal money-back guarantee.

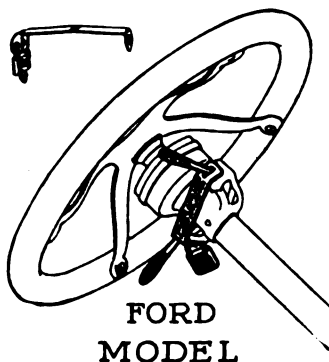
Manufactured by the Sandbo Starter Company, Rock Island, Ill. List price, \$1. Dealers should write for maker's selling proposition and discount sheet.

OLD ROMAN SOLDER.

Practically every writer on automobile mechanics has at one time or another advised the motorist to carry a complete soldering outfit so that he may be equipped to meet emergencies. Car owners will do well to investigate the merits of Old Roman solder. This ma-



Sandbo Radius Rod.

FORD
MODEL

Sturr's Locking Devices, One Being Especially For Ford Cars.

wheel, thus holding the latter rigid and making operation of the car impossible. Both devices include a lock with two keys.

Manufactured by the Sturr Auto Lock Company, 9 View place, Cincinnati, O. List price of either locking device, including lock with two keys, \$1.

JIFFY AUTO CLOTHES.

For all persons having to do with the repair or adjustment of a motor car and its parts a protecting suit is desirable equipment. One of the best outfits of this kind is shown in the accompanying illustration. It is described as the Jiffy Suit and is made of khaki, which is both waterproof and very durable, as well as dust proof. It bears the name Jiffy because it can be put on or taken off in a "jiffy." It is one piece and is provided with pockets for carrying tools and small parts.

Manufactured by the M. & N. Clothes Protector Manufacturing Company, 684 Broadway, New York City. For sale by leading automobile supply houses at a very moderate price.

TURNER MOTOR WASHERS.

Frequently the outward appearance of a motor is neglected because of the time and labor involved in the cleaning operation. This work can be made simple by the use of the Turner motor washer.

The No. MW-1 is a small hand machine with a drawn brass tank, the bottom being brazed in place and fitted with a non-leaking filler plug. The handle incorporates an automatic pump which forces the liquid through an adjustable nozzle.

No. MW-2 and MW-3 have tanks of drawn steel, equipped with a pressure gauge registering up to 100 pounds. The tanks have large hand pumps and also connections, so that they may be attached to a pressure tank or to a power driven pump. Ten feet of cloth insertion rubber hose and adjustable nozzle are fitted to these washers. Kerosene may be used as the cleansing agent if desired.

After obtaining the necessary pressure in the tank, by merely turning the nozzle either a finely divided spray or an intense needle stream can be produced. The liquid instantly cuts and washes off all grease and dirt from the motor and other working mechanism of

Jiffy Auto Suit



the car. Inaccessible parts can be reached with this stream and thoroughly cleaned. A feature of the washer is that the tank may be pumped full of air for drying and for blowing dust and other foreign matter out of the car.

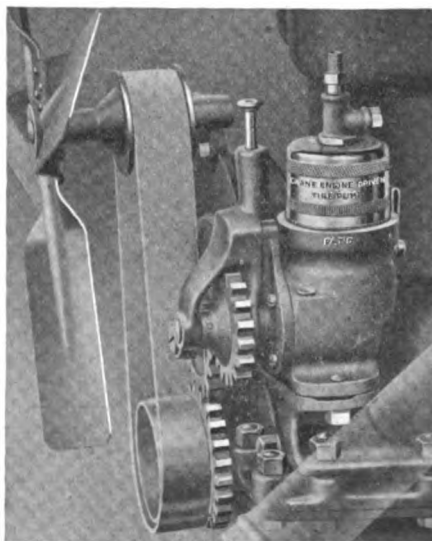
Manufactured by the Turner Brass Works, Sycamore, Ill. List price of quart size, \$4; two gallon size, \$18, and five gallon size, \$21.

NEW ERA SHOCK ABSORBER.

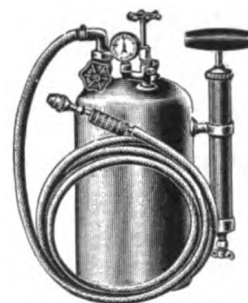
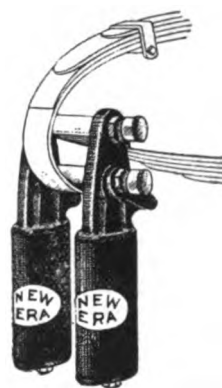
A recent announcement of new development in shock absorbers is the New Era twin elliptic type, which combines the new radius link feature that has been pronounced the greatest improvement for freedom of action ever used on elliptic absorbers.

The New Era absorbers, which are made for both Ford and other cars, have a rigid anchorage and yet allow freedom of operation. The maker declares there is no wear of plunger or bearing, that no caps can be lost, and that they afford an extremely smooth cushion effect while in service on the roughest of roads.

The method of attachment to the spring assembly is shown in the accompanying illustration. They are easily mounted and do not in any way detract



Crane Engine Driven Tire Pump.

Motor Washer,
Above; New Era
Shock Absorber at
Right.

from the appearance of the car, because they are handsomely and durably finished. The standard devices are made in four sizes. No. 1 set being for cars up to 2300 pounds in weight, No. 2 from 2300 to 3000, No. 3 from 3000 to 3800, and No. 4 from 3800 and up.

Manufactured by the New Era Spring and Specialty Company, Detroit, Mich. List prices for each different sized set, which consists of four absorbers: No. 1, \$12; No. 2, \$12.50; No. 3, \$13.50; No. 4, \$15.

CRANE TIRE PUMP.

In designing the Crane engine driven tire pump the builders have followed original lines to obtain a device that is as near perfect as possible. To eliminate the objectionable feature of spraying oil into the tire while using the pump a special alloy patented packing ring has been incorporated. This ring, which is one of the outstanding features of the Crane pump, is so arranged between the cylinder and piston that it absolutely insures the delivery of all the air contained in the cylinder into the tire free from oil.

The drive of the pump is by split gear, bored to correct size to fit the shaft on any model of car. Installation is simple and can be done by the car owner in his own garage, attachment being by adjustable brackets that fasten to bolts or studs already on the engine. No drilling or machine work of any kind is required. Crane pumps are furnished complete with every requisite necessary, including hose and pressure gauge.

Manufactured by the Bay State Pump Company, 275 Congress street, Boston, Mass. Price \$8.

O-SO-EZY POLISH.

O-So-Ezy automobile polish, which many of the leading manufacturers now include in the regular equipment of their cars, is both a cleaning and polishing fluid. It is free of acids and abrasives and nourishes and preserves varnish, paint and enamel. It removes grease, grime and dust at one application and with the minimum of time and exertion and fills and conceals surface scratches.

Manufactured by the O-So-Ezy Products Company, 264 Jefferson avenue, Detroit, Mich. Retail price, half pint can, 25 cents; pint 50 cents; quart, \$1; half gallon, \$1.50; gallon, \$2.50.

DEVELOPMENTS IN THE TRADE.

Jeffery Company Changes Hands--New Mitchell Motors Company--Page-Detroit's Big Earnings.

The entire stock of the Thomas B. Jeffery Company, Kenosha, Wis., maker of pleasure and commercial cars, has been taken over by C. W. Nash, who recently retired from the presidency of the General Motors Company, and Lee, Higginson & Company, Boston, the banking concern which financed the General Motors Company some years ago. Rumor has it that the purchase price ranges around \$9,000,000. The Jeffery company is capitalized at \$3,000,000, and that means the price would be about \$300 a share.

Mr. Nash's active connection with the Jeffery company begins August 1. It is understood that C. T. Jeffery, H. W. Jeffery and T. M. Kearney, who constitute the present board of directors, will continue in that capacity for the present at least. Further details are expected at an early date.

The Jeffery company has always held an estimable position in the motor vehicle world. It was founded about 17 years ago and now is one of the largest motor car plants in the middle west. Its Jeffery Quad, a four wheel drive truck, has been a decided success and is now extensively used for military purposes in this country and abroad.

NEW MITCHELL COMPANY FORMED.

A new company known as the Mitchell Motors Company has been formed to acquire the business of the Mitchell-Lewis Motor Car Company of Racine, Wis., and to finance the expansion of the business.

A syndicate of New York and Chicago bankers has been formed to underwrite the capital stock of the new company, which will consist of 125,000 shares without par value.

It is probable that an expenditure of \$100,000 will be made in factory improvements.

ELGIN-NEW ERA MERGER.

The Elgin Motor Car Corporation of Chicago has taken over the New Era Engineering Company of Joliet, Ill., and will include in its manufacture the light four and little delivery truck made by the latter company. The combination will make a strong organization and according to Mr. C. S. Riegan and President Brown of the Elgin Motor Car Corporation, will be of incalculable benefit because of the splendid facilities the New Era company had in getting material. It also makes an advantageous combination, as the dealers handling the Elgin Light Six found a demand also for a light four and a small delivery car.

Both companies in the merger were enjoying increasing prosperity, having their entire outputs sold, with deposits paid in advance on every car. A new

factory is now in course of erection and when completed will give the company a capacity of 40 to 50 cars per day.

NEW ELECTRICAL CONCERN.

The Wagner-Hoyt Electric Company, which will manufacture complete electrical equipment for automobiles, has been organized in New York. The principal factors in the organization are A. F. Wagner, president of the Wagner Specialties Company of New York; Frank Hoyt, formerly chief engineer of the Simms Magneto Company, and Gerald Laugh, recently with the National Cash Register and Burroughs Adding Machine companies. It is reported that the factory will be located somewhere in New Jersey. The product will be marketed as a complete unit.

CHALMERS TO HANDLE SALES

Trade interests understand that Hugh Chalmers, president of the Chalmers Motor Car Company, will himself take the direction of the sales department, which was handled by Paul Smith, recently deceased. Mr. Chalmers is acknowledged to be one of the best salesmen in the motor vehicle industry.

"SENSATIONAL NEW CAR."

Winthrop and W. J. Burdick have sold their interest in the New Era Engineering Company, Joliet, Ill., and according to an announcement by the Chicago advertising agency of Arnold Joerns Company, Inc., will introduce in the near future a new car which will be of sensational design.

Winthrop Burdick, who was treasurer and sales manager of the New Era Engineering Company, and W. J. Burdick, who was secretary and purchasing agent, have been associated in business for six years, during which time they have been very successful in building and marketing the well known New Era car.

ENTERS RUBBER GOODS FIELD.

The Brunswick Balke Collender Company, Chicago, New York, San Francisco and Paris, one of the country's largest manufacturers of hard rubber sporting goods articles, has entered the automobile field with a complete line of rubber parts and accessories, from tires to the smallest rubber unit to be found on a car. The Brunswick Skid-Not tire will be made at the Muskegon, Mich., plant, this tire being only one of the large variety of products. It will be of the wrapped tread, single cure type with black tread and side walls. Another feature of the line will be a self healing

tube. J. E. Duffield, formerly Western manager of the Thermoid Rubber Company and more recently with the United States Rubber interests, will be sales manager for the rubber goods and automobile division of the company.

DIVIDEND OF THREE PER CENT.

A dividend of three per cent. has been declared on the preferred stock of the Springfield Body Company, Springfield, Mass., and Detroit, Mich. It includes the regular dividend of two per cent. for the quarter ending June 30, and one per cent. for the period between Feb. 15 and April 1.

LEVY HANDLES MARION-HANDLEY.

The James Levy Motors Company, 23rd street and Michigan avenue, Chicago, and one of the largest dealers in the middle west handling Chalmers cars, has taken over the Marion-Handley car and given up the Chalmers agency.

Paige-Detroit Shows Increased Earnings.

On Estimated Production of 16,000 Cars in 1916 Earnings Are Expected to Be \$1,500,000.

The Paige-Detroit Motor Car Company's earnings for 1916 are estimated at \$1,500,000, as compared with actual earnings in 1915 of \$654,000 and \$123,000 in 1914.

As of June 1 the net tangible assets of the company with the full \$1,000,000 stock outstanding were \$1,504,497, or \$15 per \$10 share. The last balance sheet is as follows:

ASSETS.

Plant	\$158,733
Inventory	742,421
Service station accounts.....	154,914
Notes and accounts receivable.	120,161
Prepaid expenses.....	4,825
Cash and Detroit bonds.....	682,808

Total.....\$1,863,990

LIABILITIES.

Capital stock.....	\$1,000,000
Current accounts.....	354,668
Surplus	509,321

Total.....\$1,863,990

The earnings' record and production figures estimated for 1916 and actual for the two preceding years are presented in the following table:

	Prod.	Earnings on Stock	Per Cent.
1916 (Est.)...16,000	\$1,500,000	150	
1915	7,749	654,000	65.4
1914	5,262	123,000	12.3

The stock is now on a dividend basis of 3 per cent. per month.

This year's earnings figure at the rate of 150 per cent. on the company's outstanding stock.

STUTZ DECLARES DIVIDEND.

Directors of the Stutz Motor Car Company, Indianapolis, have declared a dividend of \$125,000, payable Sept. 1. All the stock of the company is owned by the Stutz Motor Car Company of America, recently financed by Allen A. Ryan and associates. The parent company has outstanding 75,000 shares of stock of no par value, so that the declaration of the operating company is equivalent to \$1.66 per share of stock of the Stutz Company of America. This action may be construed as indicating that the Stutz stock will shortly be placed on a \$6 dividend basis.

NEW BOSCH CONTRACTS.

The Bosch Magneto Company, New York City, reports that it has recently signed contracts for Bosch magnetos with the following concerns: Palmer-Moore Company, Syracuse, N. Y.; Sterling Automobile Manufacturing Company, New York City; International Motor Company, New York City; Thomas Auto Truck Company, South Bend, Ind.; Martin Carriage Works, York, Penn.

Overland Declares
Extra Dividend.

Company's Stock Has Been Placed On
12 Per Cent. Per Annum Basis By
Extra Dividend.

In addition to declaring a regular quarterly cash dividend of 3 per cent., which places the stock of the Willys-Overland Company on a 12 per cent. per annum basis, the directors at the recent meeting also declared an extra stock dividend of 10 per cent. The cash dividend is payable August 1 to holders of record July 24, and one half of the 10 per cent. stock dividend is payable Oct. 2 to holders of record Sept. 15, the balance being payable April 2, 1917, to holders of record March 15, 1917.

PACKARD'S FINANCIAL STANDING.

A statement of earnings dating from 1909 has been issued by the Packard Motor Car Company, Detroit, it showing that the company's earnings have been increased from \$2,612,774 in 1909 to about \$6,050,000 in 1916. The last figure is of course estimated, but it is based upon warrantable statistics. After paying regular preferred and common cash dividends and deducting the 10 per cent common stock dividend distributed Feb. 1, 1916, and the 50 per cent stock dividend to be distributed August 1, 1916, the balance in the surplus account at the end of the year is expected to exceed \$6,376,344. This figure is after deducting depreciation for seven years, aggregating more than \$9,000,000.

BIG UPHEAVAL IN NEW YORK.

Former Overland Dealer Now Handles
Chalmers---Overland Establishes Factory Branch.

Through one of the largest financial transactions ever made between an automobile dealer and a manufacturer, C. T. Silver, who has the reputation of being one of the largest retail automobile distributors in the world, becomes the agent of the Chalmers Motor Car Company in New York City, Long Island, Staten Island, New Jersey and in a part of Connecticut. The contract closed with Mr. Silver calls for \$6,250,000, a sum greater than the entire capitalization of a majority of the automobile companies in America.

The announcement that Mr. Silver had given up the Overland to take on the Chalmers, created widespread surprise in trade circles. The contract with the Chalmers company calls for 10 per cent. of their output for one year, beginning Aug. 1. The distribution will be conducted under the name of C. T. Silver, Inc. The territory covered is practically the same as he controlled as agent for the Overland, except that he will handle the parts business for the Chalmers company on the Atlantic seaboard. Besides his headquarters on Broadway Mr. Silver will maintain his branches in Newark, the Bronx, Brooklyn and Yonkers.

The story of Mr. Silver's career in the automobile business is one of dazzling brilliance, as he is yet a young man with less than 10 years' experience in the trade. He started about seven years ago with the Koehler company in New York selling Buicks. He later went to the Buick branch in Brooklyn, where he quickly distinguished himself. He next started an Overland agency in Brooklyn, later moving to Manhattan, where he es-

tablished the Overland agency.

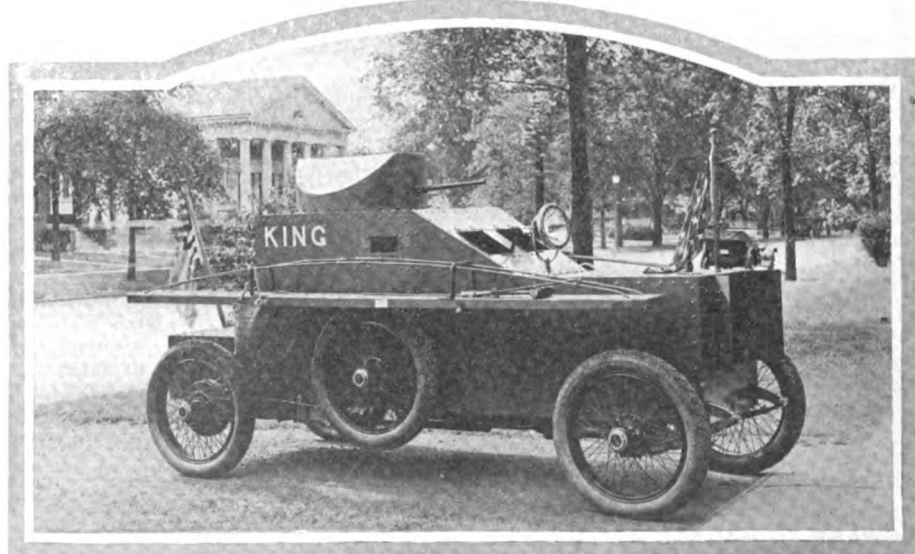
In 1914 he made a sensational business move which brought the lime light of the trade to bear upon his genius. That year he acquired the big Peerless building, which was considered the finest automobile sales building in the world. From this point he rapidly developed an extremely efficient sales organization, covering the territory mentioned.

OVERLAND OPENS N. Y. BRANCH.

A direct factory branch of the Willys-Overland Company has been opened in New York City with temporary headquarters and show room at 1826-28 Broadway. One of the finest service stations in the East, which is located at 150th street, is also prepared to take care of the needs of the thousands of Overland owners in that district. At the station there is a stock of parts worth \$100,000 and a floor area of 60,000 square feet.

These accommodations are temporary while the new building is being erected, facing on Fifty-seventh and Fifty-eighth streets, between 10th and 11th avenues. When finished the new service station will have 300,000 square feet of floor space and represent an investment of \$1,000,000. The Overland company is also planning to open factory branches and service stations in Brooklyn and Newark.

Edwin B. Jackson, who was president of the Packard Motor Car Company of New York, before becoming connected with the Willys-Overland Company, will devote a large part of his time to directing the new branch and service stations in New York.



ARMORED BODY MOUNTED ON KING EIGHT CHASSIS.

Battle Car Manufactured by New Armored Motor Car Company of Detroit, It Mounting Special Body on Standard King Eight-Cylinder Chassis—Car Has Revolving Turret and Carries Three Machine Guns.

WITH THE MEN IN THE INDUSTRY.

Paul Smith is Dead.—Changes Announced in Personnel of Several Motor Companies.

Paul Smith, vice president and general sales manager of the Chalmers Motor Car Company, Detroit, Mich., met his death under extremely tragic circumstances in New York City on July 15, falling from a window on the 10th floor of the Hotel Biltmore to the sidewalk on East Forty-fourth street.

Great sorrow is felt in trade circles over his sudden death, not alone because he was one of the most popular and highest salaried young men in the automobile industry, but that he did not live to reap the rewards and fame he had earned two days prior to his demise, in closing one of the largest automobile transactions ever made. On the previous Thursday he had signed a contract with C. T. Silver of New York through which the latter not only became the New York Chalmers agent, but agreed to take 10 per cent. of the output of the Chalmers factory during the ensuing year, which involved \$6,250,000.

There are few parallels to Mr. Smith's career in American industry. While only 33 years of age, his salary was said to be \$50,000 a year. He was born in Maine. He was graduated from the University of Illinois as a physician and practised for a time, but soon abandoned the profession and went into a Detroit automobile factory to learn the business. Later he became associated with the Goodyear Tire and Rubber Company, the Studebaker Company and the Lozier Company. About a year ago he went with the Chalmers Motor Car Company of Detroit as vice president and general manager. During the year he not only raised the number of agents from 600 to 1500, but sold \$22,000,000 worth of Chalmers cars.

WALDON LEAVES CADILLAC.

Sydney D. Waldon, who left the Packard company about a year and a half ago to take the vice-presidency of the Cadillac Motor Car Company, in charge of engineering, has resigned. It is understood that he will retire from active business life.

COLT IS COLE SALES MANAGER.

The Cole Motor Car Company announces the appointment of W. L. Colt as Eastern district sales manager. Mr. Colt will retain the presidency of the Colt-Stratton Company, sole Cole distributor in the New York territory. Harry Stratton becomes general manager.

BOWLER TO MANAGE H. A. L. SALES.

George H. Bowler has been appointed advertising and sales manager of the H. A. Lozier Company, Cleveland, O., maker of the H. A. L. car. He will be remembered by the veterans in the automobile

business as sales manager of the old Royal Tourist Car Company. Later he held the same position with the F. B. Stearns Company, and more recently had charge of sales and advertising for the Apple Electric Company, Dayton.

VAN DEUSEN WITH DETROITER

Alfred O. Dunk, president of the Detroit Motor Car Company, Detroit, announces the appointment of Walter H. Van Deusen as director of sales for the company. Mr. Van Deusen started in the automobile business with the E. R. Thomas Motor Company, maker of the "Thomas Flyer," in 1903, remaining there until 1910. He left Thomas to join



W. H. Van Deusen, Detroit Motor Car Company.

the Chalmers Motor Car Company as assistant general sales manager, joining the A. Elliott Ranney Company, New York distributors of King cars, in 1912. Just prior to leaving the Ranney company for the Detroit he had charge of the King distribution in New York City.

FIRESTONE'S SALES.

The Firestone Tire & Rubber Company reports an increase in sales since 1911 from \$7,462,581.17 to \$25,187,884.33, a total increase of 257 per cent. in five years. This fiscal year, 1915-1916, shows an advance as of June 30 of 38 per cent. over the preceding period.

C. A. BENJAMIN WITH ROSS.

C. Arthur Benjamin of Syracuse, N. Y., has been appointed sales manager of the Ross Automobile Company of Detroit. In 1900 he was sales manager of the Locomobile and served in the same ca-

capacity with the Franklin in later years, the Babcock Electric Carriage Company, the Aerocar and the American Locomotive Company. He was also at one time interested in the bicycle manufacturing business.

HOOD SERVICE BUREAU.

Wallace C. Hood, former general sales manager of the Chalmers Motor Car Company, the Everitt Motor Car Company and the Empire Automobile Company, has organized the Wallace C. Hood Service Bureau with headquarters in the Dime Bank Building, Detroit, Mich. This bureau will act as personal representative in that territory for distributors and manufacturers outside of the district.

HUMPHREY LEAVES CHALMERS.

S. H. Humphrey has taken charge of manufacturing at the Briscoe Motor Corporation, Jackson, Mich. Mr. Humphrey, who recently resigned as vice president of the Chalmers Motor Company, has had long experience in his branch of the industry. He was with the Hupp Motor Car Company over two years before joining the Chalmers company as works manager.

HALL RESIGNS FROM OLDS.

Jay Hall, general sales manager and associate executive of the Olds Motor Works for the past three years, has tendered his resignation to take effect August 1. No announcement has been made as to Mr. Hall's plans, but it is rumored that he will be seen shortly in a position of even more responsibility than the one he relinquishes.

CARBURETOR MAKER EXPANDS.

The Holt-Welles Company, Inc., sole selling agents for Browne and Browne-Branford carburetors, has been recapitalized with an increase from \$50,000 to \$200,000. The extra amount will provide for expansion of both distributing and manufacturing facilities to meet the increased demand for the company's products. E. H. Sickles will remain as president, with the sales work directly under his supervision. Arthur B. Browne, designer of the carburetor and consulting engineer for the Malleable Iron Fittings Company, maker of the carburetors, will have charge of the laboratory and experimental work. Paul Welles will be secretary and Calvert Holt treasurer.

MAY BUILD NEW CAR.

It is reported in New York that Eric H. Delling, chief engineer and designer of the Mercer Automobile Company, is to sever his connections with that company and will design a new car to bear his name. Owing to Mr. Delling's reputation as an engineer, both here and abroad, much interest is centred in the report and the trade is eagerly anticipating an announcement giving full details.

SUGGESTIONS FOR THE FORD CAR OWNER.

Removing the Rear Axle Unit from the Chassis and Disassembling the Driving Shaft and Learning the Condition of the Different Wearing Parts.

The 52nd article dealing with the operation, construction, maintenance, care and repair of the model T Ford chassis is the 13th of the series devoted to adjusting, restoration and overhauling.

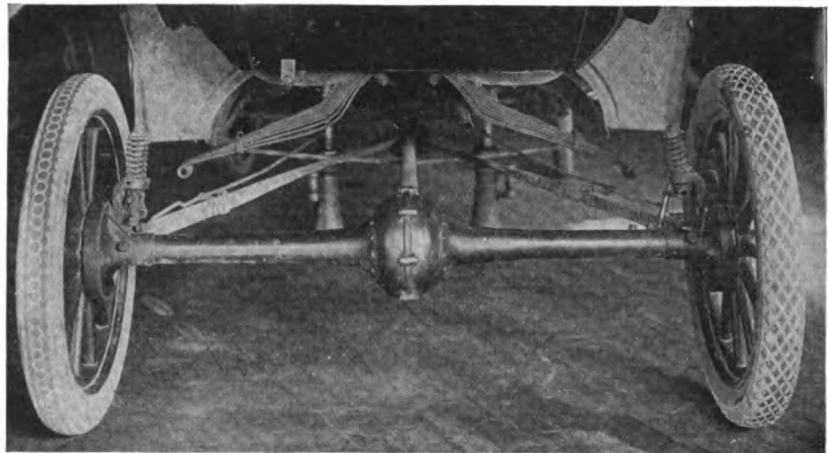
WHEN THE transmission gearset has been assembled with the engine the unit may be restored to the chassis by practically the same means that were used to remove it, or it may be kept on the bench or barrel until the work on the chassis is completed. If placed in the chassis it is out of the way and can be covered with a cloth or with the hood to protect it from dust, but if this is done there will be additional weight to the chassis, which must be considered in handling. The owner can make the choice that best serves his convenience. If the engine is restored to the chassis it should be bolted to the base and the engine head bolted on, but the gearset cover need not be replaced. The other fittings, the fan and the radiator should not be assembled until later on.

The next work is the removal of the rear axle and the main driving shaft, and before this is done the chassis should be placed where it can be worked on easily, for to overhaul this unit the body must be jacked and horses or some other support placed under it, and as moving the body will be extremely difficult unless several men are available a location where it will be most accessible until the driving system is restored is especially desirable.

The rear ends of the pressed steel crankcase and the transmission gear cover support the forward end of the driving shaft the housing of the universal joint being bolted by its flange to them. To remove the engine from the chassis only the bolts retaining the gearset cover need be taken, as the cover removal gives sufficient clearance for the gearset and the engine is lifted upward and forward. The universal joint assembly consists of two caps, so-called, which enclose the globe at the end of the driving shaft housing, both of which are hemispherical with flanges at the largest diameter. The halves when bolted together form a socket for the globe, the rear half being cut away so that the driving shaft housing may be moved in any direction, and the forward half carries a babbitt bearing for the rear end of the sleeve of the brake drum. One will understand that this bearing supports the

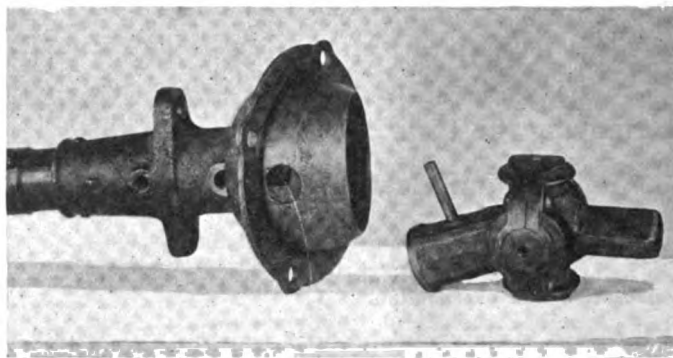
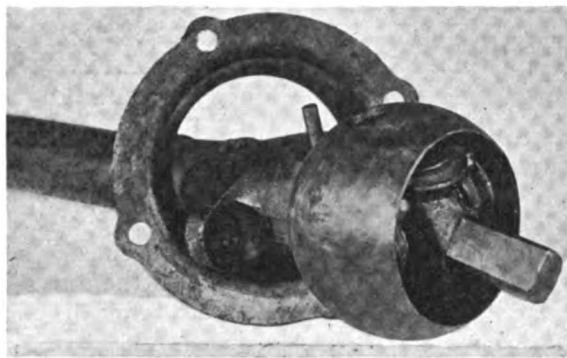
transmission gearset and the forward end of the universal joint, while the rear end of the universal joint is carried by the forward end of the driving shaft.

The forward half of the socket,—the front cap,—extends into the crankcase and it is, with the rear cap, held by four bolts through the flanges. When taking out the driving system the two lower bolts are removed and then the rear end of the body is jacked. In the accompanying illustration two large jacks were used, one at either side, which were left under the chassis. The small jack does not as a rule have sufficient lift to be serviceable for this work unless blocking is used, but a length of scantling will be a satisfactory lever and with a pair of horses and some blocks the chassis can be lifted so that the rear spring supports the rear axle and the wheels.



Removing the Rear Axle from the Chassis, the Body Being Supported by Two Jacks, the Spring Hangers and the Brake Rods Disconnected.

When this has been done the machine is in readiness for the work. The nuts are then removed from the spring hangers, which couple the springs to the perches on either brake flange, and when the hangers are separated and driven out the spring will clear the axle. The pins through the eyes of each brake rod clevis, by which it is coupled to the camshaft lever, should be driven out and the brakes disconnected, and the guides for the brake rods disconnected from the radius rods that extend from the brake brackets directly back of the universal joint on the driving shaft housing. This done the rear axle and driving shaft and radius rods can be drawn back clear of the chassis. The universal joint front cap can be taken out of the crankcase or it may be left in position, retained by the bolts and nuts. There is little probability



The Driving Shaft Universal Joint: At Left the Complete Assembly with the Set Screws Removed and the Shaft Retaining Pin Partly Driven Out; at Right the Universal Joint Withdrawn from Its Housing, the Pin Being Shown in the Hole of the Rear Member.—This Clearly Shows the Construction of the Joint.

that this cap will ever be worn,—at least to a degree that would justify replacement, and aside from cleaning it need not ordinarily be given attention.

How the Driving Thrust Is Taken.

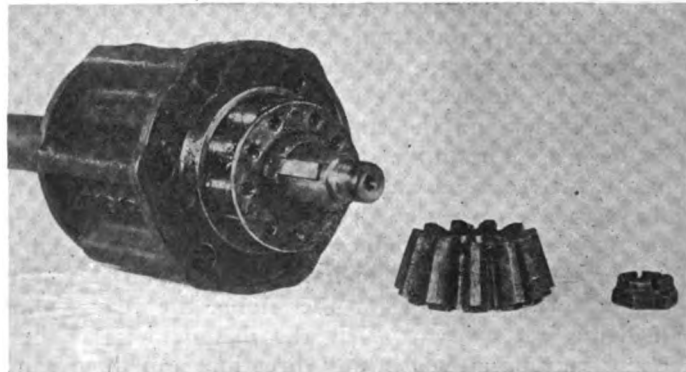
The cap carries the bearing for the brake drum sleeve and the driving shaft and it retains the globe end of the driving shaft housing. It sustains any side pressure of the sleeve of the brake drum and any forward thrust from the rear axle, either from the driving shaft or the radius rods. The engine case is fixed in the chassis frame and the thrust of the driving shaft is against the center of the rear end, so that the actual propulsion is against the chassis frame at the supporting arms of the engine. There is, of course, connection through the chassis frame and rear spring to the rear axle, and the intention is that the entire assembly shall sustain the tractive effort. The globe and socket joint affords free movement of the driving shaft, and the axle is maintained in exact relation, no matter what the degree of spring deflection or reflexion. When the car is driven in reverse there is propulsive effort directed against the rear universal joint cap and through this to the engine case and the chassis frame side members, and when the wheel or emergency brake is used there is practically the same effect, but not the same degree.

The globe or ball that incloses the universal joint is a steel casting that is really a globe on

the end of a sleeve. The bore of the sleeve is the size of the external diameter of the driving shaft housing or tube, and the opening in the globe is made to take the assembled universal joint easily. In earlier than 1915 cars the universal joint housing was in two sections, the one being a sleeve with a flange that was placed on the end of the driving shaft housing, and the other being the globe with a neck and flange that was bolted to the flange of the sleeve, the assembly being what is now made in a single part. In any event the sleeve is riveted on the driving shaft housing. When the housing is the two section type the removal of the four nuts retaining globe to the sleeve will separate the globe from the sleeve and the former may be slipped off over the universal joint. When the housing is a single piece the method of handling is different.

On the sleeve, diametrically opposite, are a pair of lugs or ears that are bored to take the forward ends of the radius rods, the rod ends being threaded and formed with shoulders that are seated against the rear sides of the lugs, the bores of which parallel the driving shaft. At the rear end of the driving shaft housing is another shorter flanged sleeve that is bolted to the bearing housing and the axle housing by six studs, three of which are carried by either side of the axle shell.

The disassembling of the driving shaft should be begun by loosening the nuts that retain the



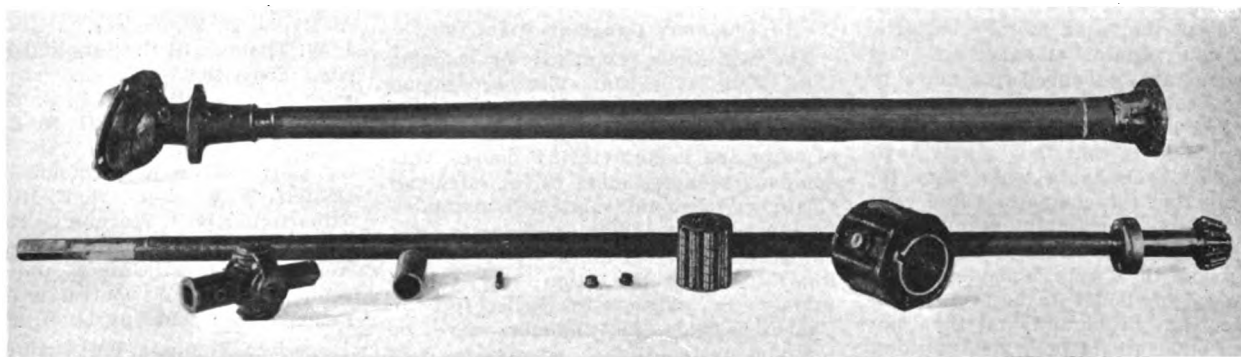
The Driving Shaft Rear Bearing and Driving Pinion: At Left the Complete Assembly; at Right the Castellated Nut and Pinion Removed, Showing the Key in the Keyway of Shaft, with the Hyatt Roller Bearing Partly Pressed Out of Its Housing.

rear ends of the radius rods to the brake flanges of the rear axle and those that secure the forward ends of the rods in the brackets on the sleeve at forward end of the driving shaft housing and taking out the rods. Then the nuts may be removed from the studs that retain the roller bearing and its housing to the flanged sleeve of the rear end of the driving shaft housing. This done, the driving shaft and its housing complete, from driving pinion to universal joint, may be removed from the rear axle. This leaves the rear axle and the wheels to be given attention.

The reader should understand that there is a top and bottom to the driving shaft housing, the top being easily recognizable by the grease cup directly back of the universal joint. This grease cup may be removed for convenience in handling, and when replacing it the top may be identified by the hole from which it was removed. The attention of the reader is directed to the illustrations of the driving shaft ends, one group showing the universal joint and its housing, another the pinion end assembled and partly dis-

assembled. The joint appears as in the illustration. There is little probability that the rivets will loosen, and the wear will undoubtedly be in the bearings of the shaft members in the riveted ring. Both the members and the rings may be considerably worn, especially if the lubrication has not been complete. There is no good reason why there should be continued use of a worn universal joint and far better judgment would be to make complete restoration by installing a new assembly. There ought to be no play in a universal joint, for lost motion at this point will extend through the entire driving system. If there is need for temporarily using the joint it should be replaced as quickly as this can be done. There is little probability that the babbitt bearing in the front universal joint cap will be worn to any material degree.

Back of the rear end of the universal joint the driving shaft is carried in a babbitt bushing that is mounted in the housing, but this will rarely be found so worn that replacement is necessary. At the rear end of the shaft the driving



The Driving Shaft Completely Disassembled: Above, the Shaft Housing with the Rear Cap for the Universal Joint; Below, the Driving Shaft, and in Front of It Are the Universal Joint, the Babbitt Shaft Housing Bushing, the Universal Joint Pin, the Screws that Close the Pin Holes in the Shaft Housing, the Roller Bearing and the Roller Bearing Housing—the Thrust Bearing Is On the Shaft.

assembled, and the third of the different parts disassembled. By referring to the universal joint group one will note that of the assembly, showing the pin that retains the squared forward end of the driving shaft in the socket of the rear or female member of the universal joint. On the sleeve, directly ahead of the radius rod lugs, will be found two set screws that should be removed. The shaft may be then turned in the housing so that the pin retaining the shaft to the universal joint may be seen. The pin is a snug fit, with the ends slightly peaned to prevent it slipping, and this may be driven out as it is seen in the illustration showing the assembly. When this has been done the universal joint may be taken out as seen in the other illustration of the picture group. Back of the radius rod lugs may be seen the hole for the grease cup.

Condition of the Universal Joint.

The universal joint consists of the rings and the male and female members. The two rings are retained by four rivets and when assembled

pinion is retained by a pinned castellated nut, and when the pin has been taken out the pinion may be driven off. The end of the shaft is tapered and the pinion is held from turning by a Woodruff key. One illustration shows the complete assembly, and the other pinion and nut removed and the Hyatt roller bearing out of the housing. After the pinion is off the roller bearing and the ball thrust bearing ahead of it may be forced out by tapping the forward end of the shaft with a lead hammer or mallet.

Generally speaking the bearings will not be found much worn if they have been properly lubricated, but they should be cleaned and examined. Sometimes the driving pinion will be chipped and possibly worn, in which event replacement is advisable. A thorough cleaning is essential. The assembly is a reversal of the disassembly and no special directions are necessary other than to pean the pin of the universal joint after it has been driven into place.

(To Be Continued.)



Harry S. Lee, General Manager.



Plant of the Chalmers Canadian Company, Walkerville, Ont.



Louis Logie, Sales Manager.

HAPPENINGS AMONG THE MANUFACTURERS.

Allen Cares for Families.

At the mobilization of Co. D, 6th O. N. G., Fostoria, O., in which were several employees of the Allen Motor Company, W. O. Allen, general manager of the motor company, announced that not only would the company assure every employee then in the ranks and those who might enlist later that they might have their "jobs" back again when they returned but that the company would care for any families that might become destitute through the military service of one on whom they were dependent. Mr. Allen voiced his belief in the proper protection of the border and that the company's promise would hold good as long as the government kept the militia on the border.

Westcott Company Moves.

The Westcott Motor Car Company has removed its office and factory from Richmond, Ind., to Springfield, O.

Franklin Dealers Gather.

Franklin dealers in all parts of the country recently gathered at the Syracuse (N. Y.) works of the H. H. Franklin Manufacturing Company to inspect the new series 9 Franklin car, which has just been formally announced. An exhibit showing all the details of the mechanism of the car, in the form of units and in separate pieces, was a feature. Addresses were made by Arthur Holmes, vice president, Ralph Murphy, engineer, John Wilkinson, consulting engineer, and G. L. Babcock, production manager.

Studebaker Gives Full Pay.

Studebaker employees enlisting in the national guard for Mexican service have been assured by the Studebaker Corporation that they will be retained on the payrolls at full pay until Dec. 31, regardless of government, state or private subscription plans for the relief of soldiers' families. In addition the Equitable Life Assurance society has agreed

to continue in force the life insurance which the employees hold under the Studebaker plan.

Chalmers Canadian Plant.

The Chalmers Company of Canada, Ltd., Walkerville, Ont., has been inaugurated with a capitalization of \$1,000,000 and a plant containing 36,000 square feet of office and manufacturing space. This company is independent of the Michigan Chalmers company and will manufacture cars of Canadian materials as far as possible to avoid the necessity of paying duty on parts from the United States. In addition to caring for the Canadian trade, all Chalmers cars for England or the British possessions will be made and shipped from the Walkerville plant. An output of 2000 cars per annum is expected, and the line will be a duplicate of the Michigan company. The officers of the company are all Canadian men. Harry S. Lee, formerly general manager of the Toledo Scale Company of Canada, is general manager. Louis Logie, formerly with the Tudhope Motor Car Company of Canada, is sales manager. Harry W. Buchanan, formerly with the Buick company, is production manager.

Overland Breaks Record Again.

The Willys-Overland Company has again smashed the record for the production of medium and high priced cars, shipping 94,155 Overland Willys-Knight cars during the six months ended June 30. The greatest single day's shipment was made March 27, when 1111 cars left the factory. In the corresponding six months period of the preceding year the company shipped 37,841 cars.

Rubber Men's Convention.

Three hundred members of the Rubber Club of America recently met in Boston to hold the annual meeting of the organization, the business sessions being interpolated with trips to surrounding pleasure resorts. The Fire-

stone Tire & Rubber Company was represented by H. S. and R. J. Firestone, H. J. Smith, H. J. Adams, E. C. Knox, C. A. Myers, H. W. Kugler, S. G. Clarkhuff, J. W. Thomas, R. E. Glass and E. S. Babcock. From the B. F. Goodrich Company were W. O. Rutherford, E. C. Tibbits, W. C. Mears, W. H. Yule, H. M. Bacon and H. K. Raymond. From the Goodyear company came W. Litchfield, Ralph Daniels, W. G. Shilts, W. E. Morris, Carl Tilburn and E. S. Stevens. The Republic company was represented by J. H. Kelley and J. M. Crautz, the Mohawk company by C. W. McLaughlin and the Pennsylvania company by H. W. Dupuy.

Reo Planning Big Business.

The Reo Motor Car and Truck factories will employ more labor and keep every department going to full capacity during 1917. The output of the plant is expected to be 50 per cent. larger than in 1916. The month of June closed with twice as much business on the company's books as was done in the same month in 1915.

Another Factory in Indianapolis.

A four-story concrete factory building, having floor area of 150,000 square feet, the main structure being 380 by 60 feet, with wings each 100 feet long, is to be erected in Kentucky avenue, Indianapolis, Ind., by the Diamond Chain & Manufacturing Company.

Timken Produces New Axle.

The Timken-Detroit Axle Company, Detroit, Mich., is now producing a worm shaft and gear wheel axle for trucks having load capacity of five tons. This is the largest size the company has yet produced. It is designed for Hotchkiss drive construction.

F-W-D to Build Extension.

A building 100 by 200 feet, which will be used as a gray iron and malleable iron foundry, is to be built by the Four Wheel Drive Auto Company, Clintonville, Wis.

MOTOR STARTING AND CAR LIGHTING.

Characteristics of the Different Systems of Reference to Lamp Connections—Types of Testers Suited for Proving the Conditions of the Circuits.

THE ONE wire system is usually constructed of cable more heavily insulated than that of the two-wire system, and the chief condition to be met is to make connections of the wiring with the chassis strong, so that they will not break or loosen, and protect them so that corrosion will not influence the conductivity of the circuit. With the two-wire system there is no reason why there should not be the highest degree of conduction, but there is more wiring and greater possibility of breakage and chafing of insulation. With the three-wire system there is still more wiring and added probability of failure, but this cannot be avoided if there is need of two voltages from a single battery.

There is less probability of broken insulation of the two-wire system causing short circuit from the fact that with both wires insulated only a break on both the positive and negative sides would result in a short circuit, because with one wire exposed there would be no leakage unless the two were bare at one place, this applying equally well to either the positive or negative wire. The fuses of the single-wire system are to some extent a guide to short circuits. Fuses or circuit breakers are not usually used with the two-wire system, but their use is practical with this construction.

Circuits with Different Voltages.

When two different voltages are obtained from one battery this is practically two circuits, although but three wires are used, and these may be either the grounded or the complete return construction. Two examples of wiring connections are shown in the accompanying illustrations, the one with the battery divided so as to be two equal sections, each of six volts, and the other with two unequal sections, the one of 12 and six volts. From the first grouping 12 volts is obtained for the head lamps from the complete battery, and six volts for the dash lamps, which are connected with the main circuit, but are also connected with the neutral wire from the centre connection of the two groups. The neutral wire and the connection to either side of the circuit affords for each lamp half the full battery voltage. The arrangement is to connect the two six-volt lamps in series in a 12-volt circuit, which is possible when all the lamps in series are of the same voltage. Two lamps of different voltages can not be used.

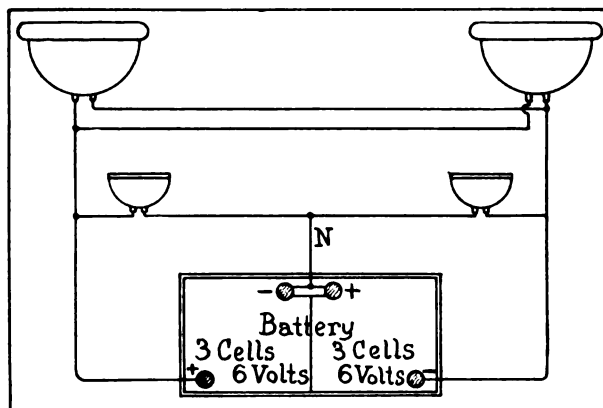
The other example referred to is with the battery unequally divided, by which three different voltages may be obtained. With this voltage supplied to the starting motor is that of the en-

tire battery, the head lamps receive 12 volts and the dash lamps six volts. The centre or neutral wire serves both the head and the dash lamps.

Current Must Have Direct Path.

An electric current must have a continuous path between the terminals, and this path should have, in the event of it being wholly or in part wiring, the greatest practical conductivity. That is to say, the wiring should be of such size and material that there will be the least resistance and it should be fully protected. The wiring, because of the proximity of metal through which it might flow should it contact with it, is protected by insulation. This insulation may be of differing materials, either cotton saturated with a compound, silk or rubber, or it may be a combination of two of these.

The wiring may be further protected by enclosing it in electrician's loom, (a tube of specially prepared paper) fiber or metal. There are



The Three-Wire Wiring System with the Battery in Equal Sections, This Affording Two Different Voltages with One Set of Lamps in Series.

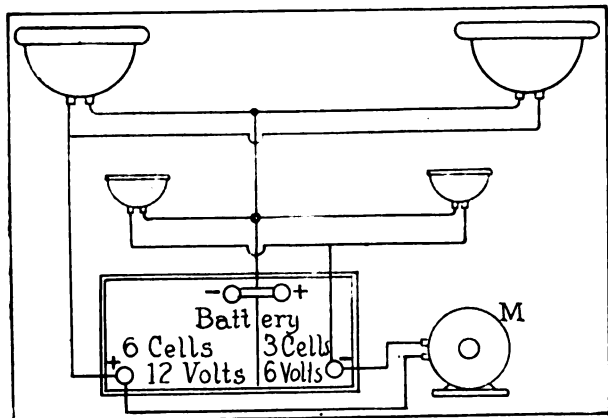
various causes for deterioration of insulation, such as saturation with oil or water, chafing so the wire may be exposed, or rupture resulting from heavy overload, any one of which might cause a flow of current to escape between the terminals. In addition to this there are the possibilities of current being interrupted because of broken wires, loose terminals, corrosion of the contacting surfaces of terminals, to say nothing of interruption in the generator, motor or the instruments by which the circuit flow is regulated or controlled.

Why Different Systems Are Used.

The single wire system of wiring means that there is a direct path provided from the generator to the battery and from the battery to the generator, and from the battery to the lamps and from the lamps to the battery through cir-

cuits which are in part made up of the frames of the car and the machines or instruments and part by wiring, and every component in the circuit, the generator, battery and lamps, must be so connected that the current must pass through them. There must be the means of control and regulation as well. If the system is one unit or two unit the single wire may be used, and if one or two unit the two-wire construction will serve, and usually the three-wire system is used with two units.

The choice of the system depends upon the work that must be done, the requirements of the designer and the amount of money that can be expended for this equipment for any one car. There are other considerations, such as accessibility, simplicity and the design of the car that enter into the determination. But no matter what the choice, the principle is not changed, for there must be the return of the current to the point of origination. With the single unit system this means the return to the generator, and with the two unit system it must return to the



The Three-Wire System Utilising the Battery in Unequal Sections So As to Obtain Three Different Voltages, Two for the Lamps and One for the Starting Motor.

generator for the lighting system and must originate at and return to the battery for the starting system. The lighting system must include the different lamps, which are known to electricians as the "load."

Necessity of Full Protection.

The size of the motor-generator of the single unit system depends upon the lamp load to be carried and the work required to turn the engine a sufficient number of revolutions so that it may take up its cycles regularly from its own power, but with the two-unit system these two factors are divided. The wiring plans are devised to insure such current as may be necessary being carried through the circuits. In planning the wiring system for a car much more attention is now given to protecting it and to insuring accessibility than was formerly believed necessary, for when wiring is not protected by conduits or is placed under upholstery where it cannot be easily traced, location of causes of failure are difficult and require labor and time, both of which

represent money when repairs are to be made.

All of the circuits of the car should be known to the owner or driver so that they can be easily traced and tested. This is often done by using different colors of insulation of wires that are not enclosed, but after a period of use the colors may not always be distinguishable. If the wiring is protected by conduits there is not the same probability of saturation or worn insulation or broken wires, and there is not as much probability of failure. For this reason the labor of making tests of circuits is minimized.

Why Tests of Circuits Must Be Made.

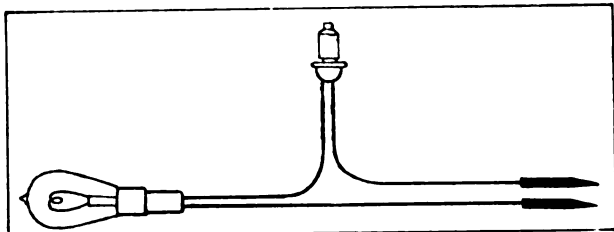
The experienced automobile electrician will examine the wiring system of a car and his general knowledge of construction and principles will dictate what tests had best be made to determine a condition. There is, of course, no occasion to go over all the wiring of a car to determine the cause of a specific defect, but in the event of failure of all circuits such an examination might be necessary. There are, however, many conditions where tests of circuits are imperative and for the purpose of saving time and being certain of results a practical tester is desirable. These may be found in large garages and service stations, as well as in many repair shops. They differ largely in construction and size, according to the need of the work.

One type of tester that may be used anywhere and any time can be constructed by an owner and driver for a trifling sum. This consists of a board about 18 inches in length and 10 inches wide, and on this board should be nailed or screwed four strips of wood that will form a shallow box or compartment, or two thin strips of metal may be screwed on it to form three loops. These strips should be about five inches apart. The loops should be of such size that they will take a standard type No. 6 dry cell. If the box is preferred to the strips this should be about 12 inches length and eight inches width and the sides about two inches high. Into this three dry cells may be placed side by side. The purpose of the box or the strips is to keep the cells on the board while it is being carried or handled.

Two Types of Circuit Testers.

At the open end of the board an electric light socket should be fitted so that the leads from it can be carried at either side. One of these leads should be about a foot long and the other five feet. The wire should be a good quality, flexible and well insulated. The leads should be stapled so that there shall be no strain on the lamp socket. The three dry cells should be connected in series, the connectors extending from the centre to the side terminals. This will leave the side terminal of the first cell and the centre terminal of the third cell from the light unconnected. Now connect the short lead from the light socket to the outside terminal of the first cell.

A piece of insulated wire of the same size and length as the long lead from the lamp socket should have a terminal soldered to it. This



One Type of Circuit Tester Designed for Use from Any Ordinary Lighting Circuit, But Not Available Elsewhere.

should be connected to the centre terminal of the third cell. This will leave two free ends, one from the dry cells and the other from the lamp sockets.

Two pieces of copper rod, each about 5 inches in length and a quarter-inch diameter, should be soldered to the ends of the leads from the tester. These can be filed to points or rounded or notched, as best suits the ideas of the owner. The rods should then be forced through two wide, thin corks, or two pieces of wood about $1\frac{1}{2}$ inches diameter and an inch thick. Or the wires may be bent into loops and soldered. The ends can be taped to insulate them if this idea is approved. When the points of the copper rods or the loops of wire are placed together a circuit will be formed if there is a lamp in the light socket. The lamp should be three volt, or one volt for each cell. It can be taken from the socket when the tester is not in use.

Such a test board will cost but little and it will be serviceable for a long time. With the cork insulation of the rods the ends of the leads can be handled quickly and placed anywhere, there being no limitations where or how it can be worked. The touching of the points of the rods to anything that will form a circuit,—a conductor,—will cause a current flow that will light the lamp. With this a wire can be traced practically the full length of the car. Such a tester can be utilized to excellent advantage and its small cost and great utility would recommend it to every car owner.

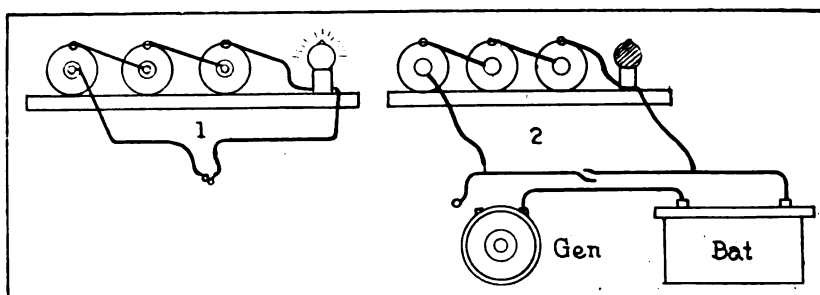
Where there are lighting circuits a tester can be made that can be similarly utilized, which is constructed to the same principle, the 110 or 220 volt lighting current taking the place of the battery of dry cells. Such a tester may be made with a regular plug such as is used for making an extension from a lighting socket, to which two wires may be connected. To the free ends two short pointed copper rods should be soldered and insulated by cork or windings of rubber tape. One of the wires is cut near the plug and a

regular lamp socket connected to the ends. A lamp may then be screwed into the socket and when the plug is placed in any lamp socket of a lighting circuit the free ends of the tester may be carried conveniently about a car, with the lamp suspended out of the way. This is used in the same manner as the other, the lamp lighting whenever a circuit is formed. The circuit is of much higher voltage, however, and greater care must be observed when using it.

One can understand the utility of such testers as have been described. The current will follow a direct conductor, and to establish a circuit with either one of the testers described will cause a lamp to light. With the dry cell battery and the three-volt lamp the illumination cannot be compared with the 110-volt lamp used with the lighting circuit when the test is made, but the degree of luminosity is the basis for judgment. The leads of the testers are of sufficient length so that they may be extended along or across a chassis, and wiring can be followed from the terminals very readily. The better way of testing is to remove the wiring from the terminals, for this will insure that the path ought to be complete, and if there are grounds between them the wire can be followed and the cause located. Or if there are other paths these can be determined and the circuit clearly established.

One can realize that such testers will save a great deal of time even with a single machine, for after a wiring system has been gone over subsequent tests can be quickly made, and where machines are worked on regularly the time economy will be of considerable importance. When the wiring is fast to terminals and the system is known a test is really a simple matter, but if the wiring has been disconnected every lead of the circuits must be tried and proven. If the leads are not differentiated by color of insulation or some other means of distinguishing them they should be marked plainly, for such marking will make similar work easier in the event that it is done in a shop or by one who is not familiar with the machine. Wiring diagrams are usually made of the systems installed in cars, but very frequently these are changed after the original installation and they cannot always be depended upon.

(To Be Continued.)



Test Set with a Battery of Dry Cells That Can Be Utilized Without Other Equipment and Is Adapted for Use in Any Garage or Shop.

MANY GAS FRAUDS DISCOVERED.

New York Inspectors Have Uncovered Several Ways of Cheating Car Owners.

The Bureau of Weights and Measures of New York City has been very active of late uncovering frauds perpetrated on unsuspecting gasoline buyers in that city. As a result of this campaign devices and ways have been discovered by which the automobile users are cheated continually.

One of the means of fraud was found in some of the automatic gasoline dispensing pumps that are so generally in use, it being learned that if the operator of the pump was dishonest he could in several ways cheat the customer either by giving short measure or by making the purchaser believe he received more gas than he actually did. In one case it was found that the operator deceived his customer in this manner by tipping the indicator on the registering device so that it indicated a greater volume of gas delivered than really went into the tank.

One of the most flagrant methods employed was discovered in the connivance of the operator and dishonest chauffeurs, the former giving very short measure while the chauffeur O. K'd the bill sent to his employer for the full amount, or, in case cash was paid at the time, the gasoline was put into the car and the operator and the chauffeur divided the money.

The extent to which these frauds were practiced was surprisingly large it was discovered and steps were immediately taken for a general campaign to discourage it by prosecuting without leniency everyone apprehended. As a result of these investigations it was also found that signs quoting low prices were used to lure customers, who sooner or later learn to their disgust that "you can't get something for nothing" and that when the price is below the average charge the article purchased is very inferior if not short in weight or volume.

Some of the dealers were found with mixtures of kerosene and gasoline which was sold as the latter fuel. Several funnels were found with large and capacious necks which were equipped with finely meshed screens at the upper end, ostensibly for the purpose of straining the gasoline but really to prevent a view into the neck so that when the dispenser shuts off the valve in the bottom of the neck he carried away about half a gallon of gas that the consumer had paid for.

BREAK UP AUTO STEALING RING.

Through the discovery of a pile of twisted, bent and hammered license number plates in San Francisco, the police of that city uncovered a ring of automobile thieves who had been operating on an extensive scale. Four arrests have been made as a result of the dis-

covery and over a dozen autos have been confiscated by the police. It has been learned that the thieves have been operating over a year during which time they have stolen more than 200 cars, a number of which were shipped to foreign countries. The shipment of one car to New Zealand and another to England, which facts were established, lead the authorities to believe that the thieves had been selling their booty abroad to avoid detection.

CROSS COUNTRY IN SEVEN DAYS.

Forty-seven stock Saxon cars participated in a relay race in which the continent was crossed from New York City to San Francisco in six days, 18 hours and 10 minutes. The first of the cars left New York City July 15 and the last one reached the California city July 22 by way of the Lincoln highway.

The relay race was planned by the Saxon company to determine what time could be made by motor cars in bearing messages over great distances. The mileage of the Lincoln highway is 3331 miles, but the distance travelled by the Saxon cars was considerably in excess of this because of the several detours made. The average speed of the machines was not less than 25 miles an hour, and each car travelled approximately 75 miles.

MASSACHUSETTS CARS.

Statistics made public by the Massachusetts Highway Commission for the first six months of 1916 show that 105,488 motor cars, including 14,800 commercial vehicles, were registered, as compared with 83,868, including 9900 commercial vehicles, in the corresponding period in 1915.

These figures show a marked increase in both the number of pleasure cars owned in Massachusetts, as well as commercial vehicles. An interesting feature of the Massachusetts registration figures is that they show a large number of second-hand cars registered.

CHALMERS FOR 1917.

The Chalmers Motor Company has announced that the 3400 revolutions-per-minute Chalmers Six-30 which had met with decided success during the past season will be made in two lengths of wheelbase for the coming year. A five passenger car with a 115-inch wheelbase, with both touring and closed body styles, is being built and also a seven-passenger touring car with a 122-inch wheelbase. On both chassis the new body designs are distinct and reflect the latest tendency in European models, having slanting hoods, tilted wind-

shields and double cowls. The seven-passenger car has leather upholstery 9 inches deep and the auxiliary seats, which are leather backed, fold under the front seats out of sight.

Another innovation is introduced by a cluster arrangement of the instruments in an aluminum housing handy to the driver instead of the old instrument board. This model will sell at \$1280.

On the same wheelbase three closed car models are being produced, the town car, limousine and touring sedan. A feature of these cars will be the exquisite design of the interior trimmings and upholstery and their luxurious details, in which the richest materials are used and were selected and arranged by Lady Duff Gordon, a well known modiste. The de luxe effect produced has also been enhanced by numerous minor refinements which tend to increase not only the comfort of the occupants but add greatly to the convenience of the machines where they are used for business purposes.

A touring car, roadster and cabriolet bodies of equally luxuriant design are furnished on the 115-inch wheel base.

PIKE'S PEAK HILL CLIMB.

The Pike's Peak Hill Climbing contests, to be held on the road leading up Pike's Peak in Colorado on August 10-11-12, will not only surpass any similar meet in America but will prove highly interesting in the motor trade as the course running 12½ miles up the Peak will make a strenuous test of both speed and motor stamina. The maximum grade is 10.5 per cent. and the average grade 7 per cent.

It is predicted by M. W. Colwell, manager of the contest, that no less than 30 cars will be entered in the contest. Otto Lelsy of Cleveland has entered a Wisconsin Special with James Weir as driver. A number of other entries have been made by manufacturers as well as professional drivers. Three Cadillacs, three Hudsons and a Studebaker special and a Peugeot are also included in the entries to date.

OCEAN TO OCEAN TRIP.

What is probably a record trip, so far as operating costs figure, was recently made by Charles N. Otto and family of Los Angeles, Cal. In driving from their home to Charlestown, Mass., in a Kissel Kar, which took six weeks and three days, the total operating expense was only \$70. Mrs. Otto drove the car throughout the entire trip, which was made over the Southern route. No hotel bills or garage expenses were paid during the trip, but on several occasions the wayside dealers asked exorbitant prices for fuel and oil, as high as \$2 a gallon being paid for lubricants and 40 cents a gallon for gasoline.

Mr. George H. Wise, 75 years old, who was in the party, brought a bottle of water from the Pacific ocean and emptied it in the Atlantic upon his arrival in Boston where he was born.



REPLACING CLUTCH LEATHER.

(V. B. M., Yonkers, N. Y.)

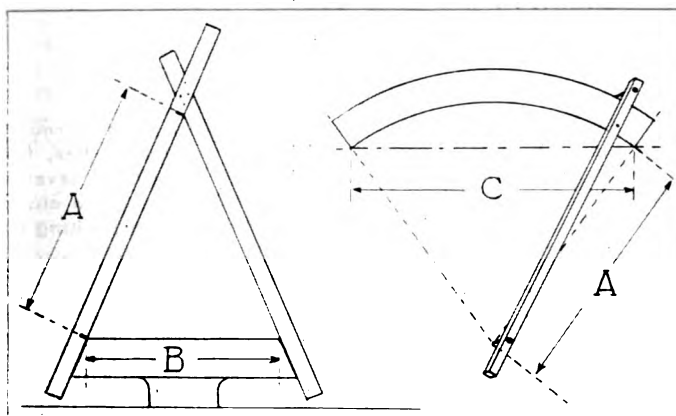
I have just replaced the leather on the clutch of my Overland car, but, although I cut it as nearly as possible to the same size and shape as the old leather, I find that, when riveted to the clutch cone it does not fit closely to the metal at the large end of the cone. It will be necessary to fit a new one, and I would be glad to have you tell me how to lay out a pattern of the right size and having the right curvature, so that it will fit snugly.

To have the leather fit properly it is essential to have the leather cut to the proper radius. To ascertain this radius, place the aluminum cone on the bench, small diameter up. Place the edges of two strips of wood, or thin metal, being sure that the edges are perfectly straight, against the face of the cone, on opposite sides, and on one strip make two marks, one where it touches the edge of cone and the other where it intersects with the other strip, as shown in the sketch. The distance between these marks is the radius for the inner edge of the leather, and the larger radius, for the outer edge of leather, will be as much longer as the width of the cone face.

Lay a large piece of wrapping paper on the floor. Use one of the wood strips as a scribe, by driving two small wire nails through it opposite the marks already made. Placing one of the nails at a fixed point on the paper, scratch a sector of a circle on the paper with the other nail. Remove one nail and move it further away from the other by a distance equal to the width of clutch face. With the same centre as before, scribe another sector, concentric with the first.

Next, carefully measure the maximum diameter of the clutch cone; i. e., the distance across the large end. Multiply this dimension by $3 \frac{1}{7}$ and lay off the resulting measurement on one of the wood strips. Using this as a rule, place the strip on the outside, or larger circle, so that the marks on the edge of strip intersect with the circle, making two marks on the circle at these points. From the same centre from which these circles, or sectors, were described, draw two lines to the marks on the large sector. These lines determine the length to which the new leather should be cut. By cutting out the pattern formed by the two curved and the two straight lines you will have a strip which will fit the cone perfectly.

If it is desired to scarf the ends of the leather and have them overlap, extend the pattern to one inch longer and cut a one-inch scarf, or bevel, on each end, taking care to cut the smooth side of leather on one end and the rough, or flesh side, on the other. It is the practise of some manufacturers to



Pattern for Cutting Leather for Cone Clutch.

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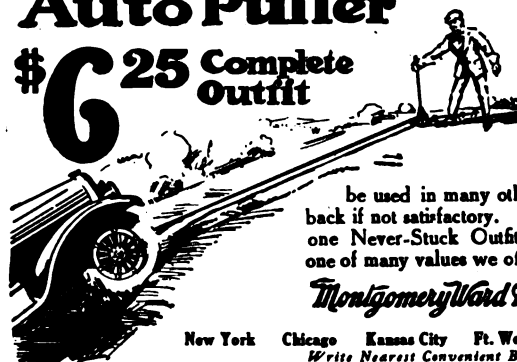
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rivet the leather to the cone with the smooth or hair side of the hide out, afterwards turning it down slightly in a lathe to remove the smooth skin and get an even surface. By turning the flesh side out this is not necessary, and the results seem to be just as good.

It might save you time to send to the nearest Overland service station or branch for a clutch leather, as they carry them in stock, with the ends glued together and all ready to rivet to the cone. It is, of course, necessary to drill holes in the facing for the copper rivets, and these holes must be countersunk about half way through the leather so that the rivet heads will not come in contact with the flywheel.

ASCERTAINING GEAR RATIOS.

(J. F. G., Putnam, Conn.)

Will you tell me in the next issue of The Automobile Journal's "Queries" section how to figure out the gear ratio of an automobile. I have seen rules for this but have forgotten the method.

Gear ratio, when used in this sense, refers to the terminal gear reduction; that is to say, the ratio in size and number of teeth between the small bevel driving pinion and the rear end of propeller shaft and the large bevel, or "master" gear, which is bolted or riveted to the differential housing. For example, if the pinion has 12 teeth and the master gear 48, the reduction, or ratio, is four to one, and four turns of the motor will revolve the rear wheels one turn when in high gear.

As to the best method of determining the ratio on any particular car, the following is probably the easiest:

Jack up one rear wheel so that it is free to turn, and make a chalk line, or other mark, at the lowest point on the rim or tire. Just under this mark make a mark on the floor. Open the relief cocks on all cylinders and put the gear shift in high. Engage the starting crank with the crank shaft of the motor and carefully note its position with relation to some fixed point on the front end of the car. Or, better still, turn the motor over slowly until the starting crank is straight up or straight down, and then make the mark on the wheel opposite the mark on floor. Now have some one watch the mark on the wheel, with instructions to "sing out" when wheel makes two complete turns and the mark on the wheel again registers with that on the floor. The wheel is revolved by slowly turning the starting crank, and the number of turns of the crank are carefully counted. If it takes four and one half turns of the starting crank to revolve the rear wheel twice, the gear reduction is 4.5 to 1.

Two turns of the wheel are counted because, with the other wheel stationary, the travel of the one which is turning will be twice as great as if both were turning, due to the action of the differential. If both wheels were jacked up but one turn would be counted, but this not only involves more labor, but is objectionable for the reason that a slight dragging of one of the brake bands might cause one wheel to lag behind the other, making the result inaccurate. In the same manner the ratio of the second and low speeds may be determined, by counting the crank shaft turns with these in mesh.

PUMP IS TROUBLESOME.

(E. N. H., Lansing, Mich.)

I am troubled very much with water leaking from around the pump shaft of my engine. There is a stuffing box, for soft packing, at this point, but, although I have tried several kinds of packing material, it remains tight only for a short while. Is my trouble due to the use of the wrong packing or is there something defective about my pump?

It is possible that your pump shaft has become scored by the use of a harsh or gritty packing material, and from setting up too tightly on the gland. We cannot understand why the use of such coarse materials as hemp, lamp wick, raw hide, etc., is persisted in when there are available such excellent packings as several asbestos and graphite combinations. These can be purchased in any supply house or hard-

ware store in a variety of sizes and are made up both in the braided and twisted form.

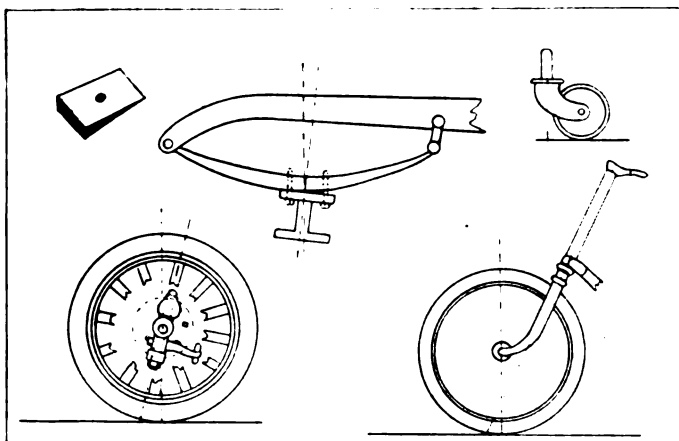
With packing of this kind a water tight joint is obtained by screwing up very loosely on the gland. The lubricating qualities of the graphite practically eliminate wear on the pump shaft. If the hole in your gland is considerably larger than the diameter of the shaft the packing will work through the clearance. This may be overcome by placing a brass washer inside the gland which has a hole very slightly larger than the shaft. If, after trying the above, you are unable to stop the leak, you will find that a new shaft will be needed, as it is either badly worn or bent.

OVERCOMING FAULTY STEERING.

(M. J. K., Bellows, Vt.)

I noticed in a recent issue of a motoring magazine a suggestion for overcoming faulty steering. The method consists of inserting a metal wedge between the front spring and axle in such a manner as to cant the axle and give the steering pivots a slight inclination. I have seen this idea applied before, but the wedges were always put in the opposite way, that is, with the thick end to the rear instead of to the front, as shown in the article referred to. Does the scheme work equally well both ways?

The easiest steering is to be had from a design of knuckle and front axle, which provides that the axis of the pivot, if produced, or extended, would strike the road at the point of contact of the tire. Some manufacturers depart slightly from this practise by having the axis inclined slightly, so



Illustrating Methods of Obtaining Easiest Possible Steering.

that, if produced, it would strike a short distance in front of the point of wheel contact. This gives what is known as "castor effect," and improves the steering by tending to keep the front wheels straight.

A good example of this construction is found in the bicycle, in which the idea is carried to somewhat greater length. Because of this feature a good rider can take his hands from the handle bar, whereas, if the steering axis were in line with the point of wheel contact on the road, this would be impossible. It will be obvious that to secure the same effect on a car the axes of pivots must be inclined the same way as the bicycle, that is, with the top of pivot inclined to the rear, as shown in the accompanying sketch. To get this inclination it is necessary to introduce the wedges with the thick ends to the rear.

SPARKING MAGNETO POINTS.

(M. E. B., Madison, Conn.)

I have had a great deal of trouble with the ignition of mycar recently. I removed the interruptor from the magneto and found the points rather far apart and badly pitted. I cleaned them up and adjusted to what I thought to be the proper opening, after which the car ran alright for about a week, when I again had trouble in starting. Have cleaned the contacts several times since but this only seems to overcome the trouble for a short time. I notice that there is considerable sparking at the points when the engine is

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running. Do you think that something has gone wrong with the magneto and should it be sent to the maker, or can you suggest some way that I can fix it myself?

Your trouble arises from either one of two things. Either the platinum point has been worn down on the adjusting screw or breaker arm, or else the condenser has been broken down or become disconnected. If the trouble is with the points inspection will show it up. If the platinum rivet on the breaker bar is working against the steel screw (the platinum having worn down), cleaning the surface will only overcome the trouble temporarily.

The obvious remedy is to fit a new rivet. If both the points appear to be all right the trouble may be in the condenser, and, in view of the sparking at the points, this is probably the case. The only thing to do is to send the magneto to the nearest service station, as the mechanism of such an instrument requires expert handling.

RUMLEY-OLDS SINGLE-CYLINDER ENGINE.

(L. B., Maddock, N. D.)

I have a Rumley-Olds single-cylinder six horsepower water cooled engine, jump spark. When this engine was used for about six months it began to knock. The gas mixer has a needle valve and when this engine was new it would run on half turn on the needle valve. But now it will knock, and if you give it a three-quarter turn it will not knock so bad. When the gasoline tank begins to get empty so the mixer will not get enough gas, it will knock as hard as if you should knock with a hammer on an anvil. The trouble seems to come from the mixer.

Judging from your description it is probable that the inside of cylinder is quite foul with carbon deposits. After it is warmed up and is working under load this will cause pre-ignition, which is always a cause of knocking.

If it is possible, remove the cylinder head so that the carbon deposit can be scraped from the inside of head and from the piston and cylinder wall. In doing this care should be taken to clean all the loose carbon out before replacing the head, as it will otherwise work down between the piston and cylinder and score the working surfaces. If the head is not removable it will be necessary to disconnect the connecting rod from crank pin and take out the piston, which will expose the combustion chamber, although it will not be quite so easy to get at.

If after cleaning out the carbon the engine still knocks, please answer to the following questions:

Has the engine good compression?

When engine was opened up was the piston found to be very loose in the cylinder, or was there any play in the wrist pin or the connecting rod bearing?

Was knocking noticed when the engine was first started up or did it only develop after heating up?

When running under full load, after getting well warmed up, will the engine run for a time after the spark is shut off?

Are you quite sure that the cylinder is getting plenty of oil and is this of good quality?

CHAIN DRIVE MACHINES.

(F. T. M., Bristol, Conn.)

I have a two-ton Mack truck with chain drive. In talking with another truck owner, who has a chain drive machine of another make, he told me that it is possible to run with only one chain, but did not make it clear how this is done. I cannot see how it is possible, unless the differential is locked, but it would be difficult to do this, and certainly impractical on a country road. Is there any other way in which it might be done?

Before the days of shaft drive it was not unusual for a motorist to get home with one chain, the method employed being to lock the free sprocket so that it could not turn. This was usually done by lashing a strip of wood or piece of metal rod to the sprocket with wire or cable and securing the other end of the bar to a spring iron, or other fixed member. The

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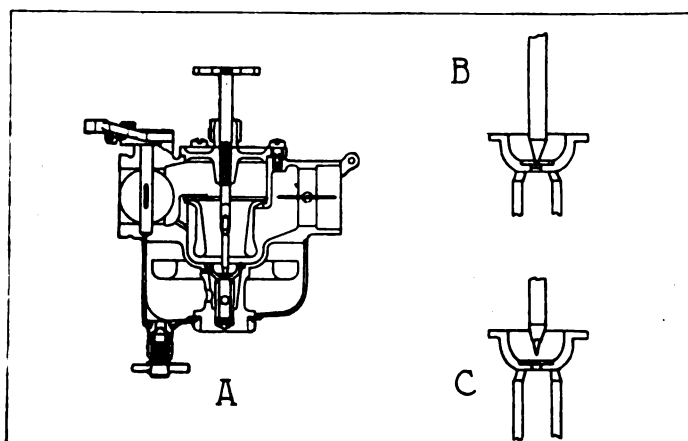
car could then be driven with one side chain working, but it was not possible to use high gear, as this would drive the car at twice the normal speed, owing to the differential action. In second speed the machine would travel about as fast as on high ordinarily.

On a truck, especially if heavily loaded, it would be much more difficult to hold the free sprocket from turning, on account of the pull, or turning effort, being so much greater, but it might be done if means could be devised to get a good, secure fastening of the bar on the sprocket. If the latter is perforated, or has spokes instead of a solid web, various ways of anchoring the bar to sprocket will suggest themselves. Carrying several spare chain links and rivets, or bolts for the same, is a better method of providing for the broken chain contingency.

ADJUSTING THE FORD CARBURETOR.

That a very large percentage of motor-ills can be traced to an improperly adjusted carburetor is a statement recently made by the Ford Motor Company in a recent issue of its house organ. While the Ford component is comparatively simple in construction, and, as a result, ordinarily easy to adjust, there are instances where it is impossible to secure a good adjustment on account of the gasoline needle and its seat being damaged. In the accompanying illustration this point is made clear.

At A is shown the carburetor adjusting needle in position for driving under normal conditions, it being open from seven eighths to a full turn; its point is seen just entering



Adjusting Ford Carburetor.

the seat. At B is illustrated the normal condition of the needle and seat. At C is shown a damaged needle and seat, the former being grooved and the latter enlarged. This condition is the result of screwing the needle down too tightly. When the parts are injured in this manner it is impossible to maintain proper adjustment. The opening will be so small that when the engine is cold it will be necessary to open the valve wider than would be the case if the parts were not damaged.

As the temperature of the motor rises, the mixture will be entirely too rich. The engine will smoke and misfire at low speeds and the consumption of fuel will be very large at high speeds.

It should seldom if ever be necessary to turn the adjusting needle down more than a quarter turn. But whenever it is done the lock nut on top of the carburetor at the point through which the needle passes should be first loosened, as otherwise it is impossible to determine when the needle is down in its seat too far. It is imperative that the lock nut be tightened again so that the adjustment will not be disturbed by the vibration of the car.

Should the motorist experience trouble when starting or should the motor misfire, and the fuel consumption has increased, it is advisable to remove the needle and inspect it. If the part is grooved, it is conclusive evidence that its seat is enlarged. The only remedy for this condition is to send the carburetor to the nearest Ford branch or agency for repairs.

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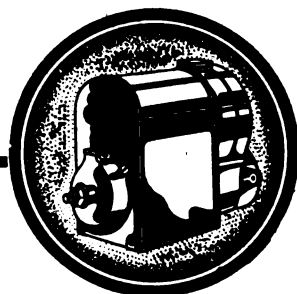
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(D. V. P., Poughkeepsie, N. Y.)

In what year and by whom was the Knight sleeve-valve motor invented? Is this an American invention and if so why is it that this type of motor became more popular abroad than in this country?

The Knight sleeve-valve motor was invented by Charles Y. Knight, an American, in Chicago, Ill., in 1903. The first Knight motor contained but a single sleeve, but in the following year two sleeves were used. This motor was first installed in an automobile built in the factory of the Garford Company, Elyria, O., in 1905. It soon attracted the attention of foreign manufacturers and, in 1906, Mr. Knight was invited by the Daimler company, one of the foremost motor car builders of England, to submit his motor for demonstration. The motor proved to be entirely satisfactory and the Daimler company adopted the Knight sleeve-valve motor for installation in their cars.

Other European manufacturers soon became interested and it was not long before the Knight motor was adopted by Panhard of France, Mercedes of Germany, Minerva of Belgium and a score of others. European Knight motored cars cost from \$4000 to \$8000, and this is no doubt the chief reason why manufacturers do not generally adopt this type of motor.

The Willys-Overland Company, Toledo, O., has adopted the Knight motor for the Willys-Knight cars. It is said that quantity production has enabled this company to sell the Willys-Knight cars at prices lower than any other Knight-motored cars in the world.

THE NECESSITY OF PISTON RINGS.

(G. C. G., Providence, R. I.)

If the pistons are accurately fitted to the cylinders, why is it necessary to use piston rings? By this I mean, why is not the piston alone sufficient to retain the compression?

The pistons do not accurately fit the cylinders. It is a well known fact that two contacting metal surfaces will result in friction unless this action is defeated by lubrication and, therefore, a little space must be allowed for a film of oil to lie between the piston and the cylinder walls. Another reason for the space between the parts is that metal expands when heated. It has been determined that the piston becomes hotter than the cylinder and, therefore, has a greater tendency to expand.

You have, no doubt, noticed that all piston rings are split, this being necessary so that they can be slipped over the piston and into place. You will also recall that the rings are springy and when placed in the cylinder have a tendency to bear on the cylinder walls at all times. The rings being of metal are also subject to contraction and expansion and it is, therefore, imperative that when the rings are placed in a cold cylinder the ends of the rings must not meet.

It is obvious that the construction throughout takes into consideration the expansion and contraction of metal at different temperatures and under this condition the only possible method is to use the springy piston rings.

Because of the necessity of having an opening in the piston rings there is always danger of compression loss through this source and it is, therefore, advisable to use some type of ring which has a sealed opening and yet does not forfeit the elasticity of the ring.

HILL CLIMBING ON HIGH GEAR.

(B. M. L., Putnam, Conn.)

I have just purchased a new pleasure car and notice that in the instruction book furnished, it is suggested to engage a lower gear rather than to make the grade on high speed. This does not appear to be reasonable advice, as I have several friends who possess cars and receive good service from them, yet they make it a practise to make most hills on the high gear. I would like to receive your opinion concerning the matter.

The suggestion referred to is generally given so that the novice driver will not cause the motor to labor while attempting to climb a steep grade on high gear. As the motorist becomes more experienced, he usually exercises his own judgment concerning this and similar matters because he becomes thoroughly acquainted with the operation of his car. The experienced operator can generally determine at

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the base of a hill whether or not the car can negotiate it on the high gear without causing the engine to labor. Providing that there is a good road and the driver has a clear vision ahead, when approaching the hill he will speed the car up on the level and then rush the grade. If, however, the motor commences to labor, shift instantly to a lower gear.

WIRING FOR BATTERY IGNITION.

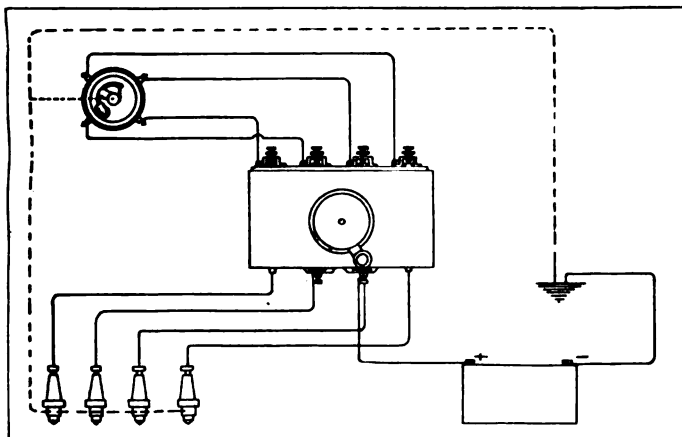
(H. P. B., Riverside, R. I.)

I am installing a four cylinder, four cycle motor in my boat in place of the two cycle motor it had when I bought it. It is equipped with jump spark ignition and I have all the parts for this but do not know how to connect the various wires. Will you please tell me how to make the various connections between the coil and commutator, and how the battery is connected, illustrating with a diagram? How many dry cells should I use?

The diagram shown herewith will illustrate the manner of connecting up the several units of the ignition system. Having attached the coil to the inside of cabin bulkhead, or in some other convenient place where it will be protected from moisture, proceed as follows:

First determine the firing order of the cylinders by watching the sequence of the inlet (or exhaust) valve openings. Then turn engine over until piston of No. 1 cylinder is on top centre. If further movement of fly wheel causes inlet valve to open, turn it all way over until the piston comes up next dead centre; otherwise leave it where it was, as this will be the firing point.

Now examine the commutator. Having in mind the di-



Wiring Diagram of a Four-Cylinder, Four-Cycle Motor.

rection in which it normally turns, see if the rotating contact is just beginning to touch one of the four insulated contacts. If not, turn the commutator in the direction contrary to that of the rotating contact until one of the insulated contacts touches it.

This will then be the contact for No. 1 cylinder, and the commutator is in the position of full retard. Without disturbing its position it should be connected with the spark advance lever with the latter in fully retarded position and in such manner that, in the advanced position, it will move the commutator against the direction in which commutator shaft turns.

Now examine the coil. All four cylinder trembling coils work on the same principle, and resemble each other in appearance, but they are arranged somewhat differently with respect to their terminals. Some have nine terminals and some have 10, the latter being more common. In either case there will be four terminals for the commutator leads and four for the high tension, or spark plug wires. The latter may be identified by the extra insulation which they have and, usually, the hard rubber ferrules which cover them. They may also be marked with the letter "S," or "H. T."

The two terminals remaining are for the battery lead and ground wire and are usually marked "B" and "G" respectively.

Connect the left hand commutator terminal on the coil to the terminal on the commutator that is touching the rotat-

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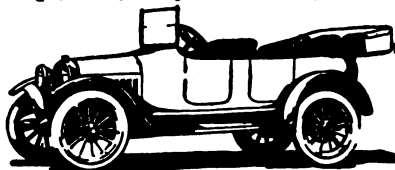
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ing contact, using a good grade of rubber covered flexible wire, about 14 gauge. Connect the left hand H. T. terminal with No. 1 spark plug, using regular high tension wire for this purpose. (Ordinary insulated wire will be sure to leak in time.)

If the firing order is 1-2-4-3, connect the second terminal of the coil with the terminal on the commutator which will next be in contact with the rotating contact, and the H. T. wire to No. 2 plug. Now connect No. 4 coil terminal with the next commutator terminal, and its corresponding H. T. wire to No. 4 plug. The No. 3 coil wire now goes to the fourth, or remaining commutator connection, and the H. T. wire to the third plug.

Now run a rubber covered wire from the "B" terminal on the coil to the positive end of battery. The negative side of the battery is "grounded," by connecting it to some part of the engine, the nearer the commutator the better. The "G" terminal on the coil is also grounded.

A switch may be inserted in the battery ground wire to open the circuit and shut off the ignition. The switch is usually mounted conveniently near the helm, or wheel, so that the engine may be stopped from that position.

REASON FOR MULTIPLICITY OF CYLINDERS.

(H. T., Norwich, Conn.)

Why is it becoming the custom to increase the number of cylinders in a motor when an engine of less cylinders will produce the same quota of power? The multiplicity of cylinders produces a heavier motor and is more complicated. Is it because the greater number of cylinders produces more power impulses to a revolution of the crankshaft and thereby affords smoother operation?

There are several good reasons for the engine designer favoring multiplicity of cylinders rather than a motor of a less number of large cylinders. The multiple cylinder motor delivers a greater number of power impulses to the crankshaft in a specified period and thereby reduces vibration to the minimum and allows engine throttling to the extreme without causing jerky operation. The chief reason for the greater number of cylinders is that a gain in power is afforded without increasing the size of the cylinders. You are mistaken in the weights of the different motors. It has been determined that the weights do not vary greatly between a motor consisting of a multiplicity of cylinders and a motor of a lesser number of cylinders of the same power. If the cylinders are small it is obvious that each impulse delivered to the crankshaft will be light and to compensate for this a greater number of impulses are delivered at each revolution. As can be expected the lighter impulse has not much effect upon the bearings and the other working parts involved. Besides this, the small cylinder is easily cooled and is therefore not so susceptible to heat as the larger cylinder.

UPWARD INCLINATION OF COOLING SYSTEM.

(D. M. W., Attleboro, Mass.)

To settle a wager, will you kindly answer the following: A bets that the upward inclination of the water pipe from the engine to the top reservoir of the radiator is of non-importance to the operation of the circulating system. B wagers that this design is of some importance.

B is right. In the majority of cases the top opening of the radiator is considerably higher than the cylinder heads. The reason for this design is that when the water becomes heated it generates steam. Under certain conditions a high steam pressure is produced and if the pipe had no upward inclination there would be danger of the steam settling in the highest portions and thus impeding the flow of water. On the other hand, when the pipe is given an upward inclination, the steam has a tendency to rise into the radiator, where it is cooled and condensed into water, or if it be in excess quantity, passes out of the radiator through the overflow pipe.

When any metal part of the car commences to crack, this action can be checked by drilling a small hole at each end of the crack. The same remedy applies when a small blow out occurs in a tube and it is desired to repair it. Punch a hole at each end of the cut and then apply the patch.

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